



Aerospace Medicine  
and Biology  
A Continuing  
Bibliography  
with Indexes

NASA SP-7011 (341)  
October 1990

(NASA-SP-7011(341)) AEROSPACE MEDICINE AND  
BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH  
INDEXES (SUPPLEMENT 341) (NASA) 50 p

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## ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)    N90-23340 — N90-25071

IAA (A-10000 Series)    A90-38845 — A90-42519

# **AEROSPACE MEDICINE AND BIOLOGY**

**A CONTINUING BIBLIOGRAPHY  
WITH INDEXES**

**(Supplement 341)**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in September 1990 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



National Aeronautics and Space Administration  
Office of Management  
Scientific and Technical Information Division  
Washington, DC

1990

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# INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 133 reports, articles and other documents announced during September 1990 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1990 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

# TABLE OF CONTENTS

	Page
<b>Category 51    Life Sciences (General)</b>	<b>243</b>
<b>Category 52    Aerospace Medicine</b> Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.	<b>246</b>
<b>Category 53    Behavioral Sciences</b> Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.	<b>252</b>
<b>Category 54    Man/System Technology and Life Support</b> Includes human engineering; biotechnology; and space suits and protective clothing.	<b>257</b>
<b>Category 55    Space Biology</b> Includes exobiology; planetary biology; and extraterrestrial life.	<b>265</b>
<b>Subject Index .....</b>	<b>A-1</b>
<b>Personal Author Index .....</b>	<b>B-1</b>
<b>Corporate Source Index .....</b>	<b>C-1</b>
<b>Foreign Technology Index .....</b>	<b>D-1</b>
<b>Contract Number Index .....</b>	<b>E-1</b>
<b>Report Number Index .....</b>	<b>F-1</b>
<b>Accession Number Index .....</b>	<b>G-1</b>

# TYPICAL REPORT CITATION AND ABSTRACT

**NASA SPONSORED**  
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**CORPORATE SOURCE**

**ACCESSION NUMBER** → **N90-10571\*** Virginia Univ., Charlottesville. Dept. of Environmental Sciences.  
**TITLE** → **A SIMPLE, MASS BALANCE MODEL OF CARBON FLOW IN A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM**  
**AUTHOR AND PUBLICATION DATE** → **JAY L. GARLAND** Mar. 1989 37 p Prepared in cooperation with Bionetics Corp., Cocoa Beach, FL  
**CONTRACT NUMBER** → (Contract NAS10-10285)  
**REPORT NUMBERS** → (NASA-TM-102151; NAS 1.15:102151) Avail: NTIS HC A03/MF A01  
**COSATI CODE** → CACL 05/8

**AVAILABILITY SOURCE**  
**PRICE CODE**

Internal cycling of chemical elements is a fundamental aspect of a Controlled Ecological Life Support System (CELSS). Mathematical models are useful tools for evaluating fluxes and reservoirs of elements associated with potential CELSS configurations. A simple mass balance model of carbon flow in CELSS was developed based on data from the CELSS Breadboard project at Kennedy Space Center. All carbon reservoirs and fluxes were calculated based on steady state conditions and modelled using linear, donor-controlled transfer coefficients. The linear expression of photosynthetic flux was replaced with Michaelis-Menten kinetics based on dynamical analysis of the model which found that the latter produced more adequate model output. Sensitivity analysis of the model indicated that accurate determination of the maximum rate of gross primary production is critical to the development of an accurate model of carbon flow. Atmospheric carbon dioxide was particularly sensitive to changes in photosynthetic rate. The small reservoir of CO<sub>2</sub> relative to large CO<sub>2</sub> fluxes increases the potential for volatility in CO<sub>2</sub> concentration. Feedback control mechanisms regulating CO<sub>2</sub> concentration will probably be necessary in a CELSS to reduce this system instability.

Author

# TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

**NASA SPONSORED**  
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**CORPORATE SOURCE**  
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**ACCESSION NUMBER** → **A90-11091\*** Krug International, San Antonio, TX.  
**TITLE** → **DETERMINING A BENDS-PREVENTING PRESSURE FOR A SPACE SUIT**  
**AUTHORS** → **R. W. KRUTZ, JR., J. T. WEBB** (Krug International, Technology Services Div., San Antonio, TX), and **G. A. DIXON** (USAF, School of Aerospace Medicine, Brooks AFB, TX) **SAFE Journal**, vol. 19,  
**PUBLICATION DATE** → Fall 1989, p. 20-24. Research sponsored by USAF. refs (Contract NASA ORDER T-82170)  
 Copyright

**AUTHORS' AFFILIATION**  
**JOURNAL TITLE**

Research conducted to determine the proper pressure for preventing bends during EVA without preoxygenation is examined. Male and female subjects with different breathing gas mixtures and pressures are studied in order to define the pressure. Visual and auditory Doppler ultrasonic signals are utilized to monitor intravascular gas bubbles. The workload, which simulates EVA, consists of a handturned bicycle ergometer, a torque wrench operation, and a rope pull. The experimental data reveal that the minimum space suit pressure needed to prevent decompression sickness is 9.5 psi.

I.F.



# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 341)*

OCTOBER 1990

51

## LIFE SCIENCES (GENERAL)

**A90-39646\*** California Univ., Los Angeles.

### **INTERACTIVE EFFECTS OF NUTRITION, ENVIRONMENT, AND RAT-STRAIN ON CORTICAL AND VERTEBRAL BONE GEOMETRY AND BIOMECHANICS**

R. F. ZERNICKE, K.-C. LI, G. J. SALEM (California, University, Los Angeles), A. C. VAILAS (Wisconsin, University, Madison), and R. E. GRINDELAND (NASA, Ames Research Center, Moffett Field, CA) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, July 1990, p. 640-647. Research supported by the University of California. refs

(Contract NAG2-479)

Copyright

An investigation was conducted to generate comparative data on the sensitivity of cortical- and vertebral-bone adaptations in two different rat strains maintained at conditions typical for spaceborne experiments conducted by U.S.A. and USSR. The effects of cage environment, diet, and rat-strain on the cortical (humerus) and vertebral (T7) bones of male Taconic-Sprague-Dawley and Czechoslovakian-Wistar rats were investigated using different flight-simulation cages (one rat/cage for U.S.A.; ten rats/cage for USSR conditions) and fed either U.S.A. or USSR diet. The results showed significant effects of these factors on the humeral and vertebral geometry and mechanical properties, as well as significant interactive effects on the mechanical properties of the humerus. I.S.

**A90-39647\*** Louisville Univ., KY.

### **EFFECTS OF SPACEFLIGHT ON LEVELS AND ACTIVITY OF IMMUNE CELLS**

GERALD SONNENFELD, WALLACE D. BERRY (Louisville, University, KY), ADRIAN D. MANDEL (NASA, Ames Research Center, Moffett Field, CA), IRENA V. KONSTANTINOVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR), GERALD R. TAYLOR (NASA, Johnson Space Center, Houston, TX) et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 61, July 1990, p. 648-653. refs

(Contract NAG9-234)

Copyright

Experiments were carried out on cells from rats that had been flown on Soviet Biosputnik Cosmos 1887 to explore the effects of spaceflight on immune responses. Rat bone marrow cells were examined for their response to colony stimulating factor-M. Rat spleen and bone marrow cells were stained with antibodies directed against cell surface antigenic markers. The results of the studies indicate that bone marrow cells from flown rats showed a decreased response to colony stimulating factor. There was a higher percentage of spleen cells from flown rats staining positively for pan-T-cell, suppressor-T-cell, and interleukin-2 receptor cell surface antigens. A small increase in the percentage of cells staining positively for helper-T-cell antigens was also noted. In addition, a higher percentage of cells that appeared to be part of the

myelogenous population of bone marrow cells from flown rats stained positively for surface immunoglobulin. Author

**A90-39821\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

### **MODEL OF CARBON FIXATION IN MICROBIAL MATS FROM 3,500 MYR AGO TO THE PRESENT**

LYNN J. ROTHSCCHILD and ROCCO L. MANCINELLI (NASA, Ames Research Center, Moffett Field, CA) *Nature* (ISSN 0028-0836), vol. 345, June 21, 1990, p. 710-712. Research supported by NASA and U.S. National Research Council. refs

Copyright

Using modern microbial mats as analogs for ancient stromatolites, it is shown that the rate of carbon fixation is higher at the greater levels of atmospheric CO<sub>2</sub> that were probably present in the past. It is suggested that carbon fixation in microbial mats was not carbon-limited during the early Precambrian, but became carbon-limited as the supply of inorganic carbon decreased. Carbon limitation led to a lower rate of carbon fixation, especially towards the end of the Precambrian. C.D.

**A90-40074**

### **OXIDATIVE PHOSPHORYLATION SYSTEM DURING STEADY-STATE HYPOXIA IN THE DOG BRAIN**

S. NIOKA, D. S. SMITH, B. CHANCE, H. V. SUBRAMANIAN, S. BUTLER (Pennsylvania, University, Philadelphia) et al. *Journal of Applied Physiology* (ISSN 0161-7567), vol. 68, June 1990, p. 2527-2535. refs

(Contract NIH-NS-22881; NIH-NS-23859; NIH-HL-07286; NIH-NS-62307)

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Regulatory mechanisms that maintain the energy metabolism of an organism during hypoxia are investigated by examining the relationship between biochemical and physiological responses and tissue-oxygen content in the brain of anesthetized and mechanically ventilated dogs. Steady-state graded hypoxia was induced by decreasing the fraction of inspired O<sub>2</sub> stepwise at 20-min intervals. Results obtained using P-32 spectroscopy demonstrate that the ATP synthesis in the brain can be maintained during hypoxia because of compensatory changes in NADH, ADP, and inorganic phosphorus. I.S.

**A90-40075**

### **EFFECTS OF COLD AND CAPSAICIN DESENSITIZATION ON PROSTAGLANDIN E HYPOTHERMIA IN RATS**

STEVEN G. SHIMADA, JOHN T. STITT, and PANAGOULA ANGELOGIANNI (John B. Pierce Foundation; Yale University, New Haven, CT) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 68, June 1990, p. 2618-2622. refs

(Contract NIH-5-R01-DK-35882; NIH-NS-11487)

Copyright

**A90-40377\*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

### **PRELIMINARY CRYSTALLOGRAPHIC EXAMINATION OF A NOVEL FUNGAL LYSOZYME FROM CHALAROPSIS**

DANIEL C. CARTER, XIAO-MIN HE (NASA, Marshall Space Flight Center, Huntsville, AL), JAMES E. LYNE, GERALD STUBBS, and JOHN H. HASH (Vanderbilt University, Nashville, TN) *Journal of Biological Chemistry* (ISSN 0021-9258), vol. 265, April 25, 1990,

p. 6928-6930. Research supported by the Universities Space Research Association. refs  
(Contract NIH-GM-33265; NIH-AI-06712; NSF PCM-76-09691)  
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The lysozyme from the fungus of the *Chalaropsis* species has been crystallized. This lysozyme displays no sequence homology with avian, phage, or mammalian lysozymes, however, preliminary studies indicate significant sequence homology with the bacterial lysozyme from *Streptomyces*. Both enzymes are unusual in possessing beta-1,4-N-acetylmuramidase and beta-1,4-N,6-O-diacetylmuramidase activity. The crystals grow from solutions of ammonium sulfate during growth periods from several months to a year. The space group is  $P2(1)2(1)2(1)$  with  $a = 34.0$  Å,  $b = 42.6$  Å,  $c = 122.1$  Å. Preliminary data indicate that there is 1 molecule/asymmetric unit. Author

A90-41265

#### ELECTRONIC MODULATION OF BIOMATERIAL FUNCTIONS

MASUO AIZAWA (Tokyo Institute of Technology, Japan) IN: International Workshop on Intelligent Materials, Tsukuba, Japan, Mar. 15-17, 1989, Proceedings. Tokyo, Society of Non-Traditional Technology, 1989, p. 209-215.

Copyright

A conceptual design is proposed for an 'intelligent material' in which a receptor protein recognizes the molecules of neurotransmitters which can trigger the activation of adenylate cyclase, ion channels, and tyrosin kinase. This sensing function is systematically linked with the effector function in the molecular assembly; the effector function is completely modulated by the sensing function of the receptor protein. Attention is given to the behaviors of an electroconductive enzyme membrane that serves as a paradigm of intelligent materials, as well as to the details of the scheme for the electronic modulation of enzyme activity. O.C.

A90-41819

#### EFFECT OF CENTRIFUGATION ACCELERATION FOR 3 WEEK'S 2G ON GROWTH IN DEVELOPING COCKERELS

SHUSHICHI TAKAHASHI, HIDEYUKI ITO, TAKAHIRO TAIRA, JUNKO YAMAZAKI (Nihon University, Tokyo, Japan), MASAKATSU SHIOYA (Nihon University, Fujisawa, Japan) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 26, June 1, 1989, p. 41-46. refs

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The effects of a continuous load of 2G on the development of cockerels was studied using centrifugal acceleration. The study involved three groups of 10-day-old cockerels under different conditions for three weeks. The conditions included a 1G breeding room, a 2G centrifugal accelerated environment, and a 1G environment near the 2G centrifugal acceleration. The effects of acceleration on body weight and the leg bone and muscle weight were examined. The group that was kept in the breeding room weighed the most. It is found that the weights of legs, muscles, and bones in 2G centrifugal acceleration group were significantly larger than the weights of the group in the 1G environment near the 2G acceleration. R.B.

A90-41820

#### EFFECT OF BODY SUSPENSION HYPOKINESIA ON SKELETAL MUSCLE TRAINED PREVIOUSLY BY ENDURANCE EXERCISE

TOSHITADA YOSHIOKA (St. Marianna University School of Medicine, Kawasaki, Japan) and HIROAKI TAKEKURA (National Institute of Fitness and Sports, Kanoya, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 26, June 1, 1989, p. 47-57. In Japanese, with abstract in English. refs

Copyright

Rats that had been forced to exercise by endurance running training were exposed to hypogravity to study the possibility of preventing degenerative alterations in structural and functional properties of skeletal muscle caused by hindlimb suspension hypokinesia. The capacities of oxidative and glycolytic enzymes

and volumes of mitochondria from different types of muscle fiber were measured. It is shown that the mean wet weight of soleus muscle is markedly decreased by suspension. The muscle suspended after endurance exercise showed less of a decrease in weight than muscle suspended without exercise. Also, it is found that the activity of succinate dehydrogenase decreased in FOG and FG fibers after suspension and increased in all types of fiber after endurance exercise. R.B.

A90-41874

#### CORTICAL MICROSTIMULATION INFLUENCES PERCEPTUAL JUDGEMENTS OF MOTION DIRECTION

C. DANIEL SALZMAN, KENNETH H. BRITTEN, and WILLIAM T. NEWSOME (Stanford University, CA) Nature (ISSN 0028-0836), vol. 346, July 12, 1990, p. 174-177. Research supported by NIH and U.S. Navy. refs

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The hypothesis that the brain constructs its percept of the visual scene from information encoded in the selective responses of visual cortex neurons has been tested directly by measuring the effect on psychophysical performance of modifying the firing rates of physiologically characterized neurons. Rhesus monkeys were required to report the direction of motion in a visual display while clusters of directionally selective neurons in the middle temporal visual area were electrically stimulated. Microstimulation biased the animals' judgements towards the direction of motion encoded by the stimulated neurons. This result indicates that physiological properties measured at the neuronal level can be causally related to a specific aspect of perceptual performance. C.D.

A90-41954

#### BIOPHYSICAL AND CLINICAL ASPECTS OF HELIOBIOLOGY: COLLECTION OF SCIENTIFIC WORKS [BIOFIZICHESKIE I KLINICHESKIE ASPEKTY GELIOBIOLOGII: SBORNIK NAUCHNYKH TRUDOV]

M. N. GNEVYSHEV, ED. and A. I. OL', ED. Leningrad, Izdatel'stvo Nauka (Problemy Kosmicheskoi Biologii. Volume 65), 1989, 232 p. In Russian. No individual items are abstracted in this volume.

Copyright

Papers are presented concerning the effects of solar activity on the earth's biosphere. Statistical clinical investigations of the effects on humans of natural geomagnetic-field perturbations due to solar activity are presented together with the results of animal experiments in weak artificial electromagnetic fields. Mechanisms of heliobiological relationships are examined in connection with physical processes occurring in water and water systems. B.J.

N90-23861\*# National Aeronautics and Space Administration, Washington, DC. Div. of Life Sciences.

#### STRATEGIC IMPLEMENTATION PLAN

Apr. 1989 46 p  
(NASA-TM-102907; NAS 1.15:102907) Avail: NTIS HC A03/MF A01 CSCL 06C

The Life Science Division of the NASA Office of Space Science and Applications (OSSA) describes its plans for assuring the health, safety, and productivity of astronauts in space, and its plans for acquiring further fundamental scientific knowledge concerning space life sciences. This strategic implementation plan details OSSA's goals, objectives, and planned initiatives. The following areas of interest are identified: operational medicine; biomedical research; space biology; exobiology; biospheric research; controlled ecological life support; flight programs and advance technology development; the life sciences educational program; and earth benefits from space life sciences. J.P.S.

N90-23862# Naval Aerospace Medical Research Lab., Pensacola, FL.

#### EFFECTS OF CHOLINERGIC DRUGS ON EXERCISE PERFORMANCE AND SIMPLE REACTION TIME OF RHESUS MONKEYS Interim Report, Sep. 1985 - Sep. 1986

JOHN A. DANDREA, JAMES C. KNEPTON, and J. O. DELORGE

20 Nov. 1989 26 p  
(AD-A219455; NAMRL-1349) Avail: NTIS HC A03/MF A01  
CSCL 06/15

Four juvenile rhesus monkeys were trained to perform an exercise response and respond aperiodically to a visual signal. The exercise response simulated a rowing motion and typically resulted in heart rates in excess of 200 beats per minute. A red signal light was usually displayed during the exercise period. Using a partial reinforcement schedule, the red light was replaced aperiodically with a green signal light that indicated a reaction-time condition. Responses on a lever within 1 s of the green light onset resulted in a food pellet. The drugs atropine sulfate, pralidoxime chloride, pyridostigmine bromide, scopolamine hydrobromide, and meclizine hydrochloride were administered concurrently or individually before the exercise session. Atropine sulfate and pralidoxime hydrochloride were administered in three dose levels. The current drug administration produced significant dose-related decrements in exercise responses and increases in postreinforcement pause times. Tail temperatures during drug testing generally were below baseline temperatures. Only atropine sulfate, when tested individually, produced behavioral effects. Neither concurrent nor individual administration of the drugs produced any reaction-time change. The availability of tapwater during training and drug testing sessions did not alter atropine sulfate effects on performance. GRA

**N90-23863#** Naval Aerospace Medical Research Lab., Pensacola, FL.

**HIGH PEAK POWER MICROWAVE PULSES AT 2.37 GHZ: NO EFFECTS ON VIGILANCE PERFORMANCE IN MONKEYS**  
Interim Report, Feb. 1988 - Feb. 1989

JOHN A. DANDREA, JAMES C. KNEPTON, B. L. COBB, B. JON KLAUENBERG, J. H. MERRITT, and DAVID N. ERWIN 2 Nov. 1989 19 p Prepared in cooperation with School of Aerospace Medicine, Brooks AFB, TX  
(Contract AF PROJ. 7757)  
(AD-A219570; NAMRL-1348; USAFSAM-TR-89-21) Avail: NTIS HC A03/MF A01 CSCL 20/14

The current safety standards for occupational exposure radio frequency and microwave exposure do not limit the peak power of microwave pulses. To evaluate whether short-duration (93 ns) high-peak-power microwave pulses can alter behavioral performance, four rhesus monkeys were exposed to peak powers of 7.02 to 11.30 kW/cm<sup>2</sup> while they performed a vigilance task. The behavior consisted of two components: responding on a variable interval schedule on one lever and to reaction time on a second lever. Correct responding on each lever was signaled by auditory stimuli. Trained monkeys performed the task during exposure to 2.37-GHz microwave pulses delivered concurrently with the auditory signals. The estimated peak whole-body specific absorption rate (SAR) for each pulse was between 582.7 and 937.9 kW/kg (54 to 87 mJ/kg per pulse). Compared to sham irradiation, significant changes in behavioral performance were not observed. GRA

**N90-23864#** Messerschmitt-Boelk-Blohm G.m.b.H., Munich (Germany, F.R.). Central Labs.  
**BIOSENSORS FOR THE DETECTION OF HEAVY METAL IONS**  
R. HILPERT, F. BINDER, and M. H. ZENK (Technische Univ., Munich, Germany, F.R.) 1989 12 p  
(MBB-Z-0289-89-PUB; ETN-90-96778) Avail: NTIS HC A03/MF A01

Phytochelatin, metallothioneins and glutathione are under investigation as biological components for the development of biosensors for heavy metal ion detection in aqueous solutions. These peptides/proteins selectively bind heavy metal ions by thiolate complex formation. If the biological component is immobilized on the surface of an appropriate transducer, changes within the layer of immobilized peptides/proteins (e.g., release of protons, changes of mass and optical properties), effected by binding of metal ions, may be transformed into electrical signals by the transducer (proton-sensitive field effect transistor, mass-sensitive piezoelectric crystal or optical device). Preliminary

experiments are made which demonstrate the suitability of phytochelatin and glutathione as biological components for the development of biosensors for heavy metal. ESA

**N90-24710#** Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Abt. Biophysik.  
**IN VITRO PHOTOREACTIVATION OF TRANSFORMING DNA OF BACILLUS SUBTILIS SPORES AFTER IRRADIATION WITH UV LIGHT** Ph.D. Thesis - Bonn Univ.

CORINNA PANITZ Aug. 1989 103 p In GERMAN; ENGLISH summary

(DLR-FB-89-45; ISSN-0171-1342; ETN-90-96454) Avail: NTIS HC A06/MF A01; DLR, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, 37.50 DM

The influence of UV radiation on the transforming system of bacillus subtilis spores and, for comparison, of vegetative cells was investigated. The UV sensitivity of transformation depends on the state of the DNA. Transformation is less UV-sensitive if DNA is UV-irradiated inside the bacterial spore as compared to in vitro UV irradiation. Photoreactivation only occurs after in vitro UV irradiation. Future study is planned to discover to what extent the enhanced UV sensitivity of bacillus subtilis spores, UV-irradiated in vacu, is due the UV-induced cis-syn thymine dimer. ESA

**N90-24711#** Massachusetts Inst. of Tech., Cambridge. Dept. of Brain and Cognitive Sciences.

**STRATEGIES TO SUSTAIN AND ENHANCE PERFORMANCE IN STRESSFUL ENVIRONMENTS** Final Report, 30 Sep. 1987 - 14 Dec. 1989

HARRIS R. LIEBERMAN, ANDREW B. DOLLINS, and RICHARD J. WURTMAN 14 Mar. 1990 24 p  
(Contract AF-AFOSR-0402-87; AF PROJ. 2312)  
(AD-A221224; AFOSR-90-0403TR) Avail: NTIS HC A03/MF A01 CSCL 06/15

Tyrosine, a large neutral amino acid normally present in protein foods, is the precursor of the catecholamine neurotransmitters dopamine, norepinephrine, and epinephrine. Animal studies indicate that systemic administration of tyrosine in pharmacologic quantities can reduce physiological and behavioral decrements induced by highly stressful conditions. The current study was designed to test the effects of tyrosine on humans exposed to cardiovascular stress. Physiological (HR, BP, AER, EOG, and EMG) and Behavioral (Rt, Mood, and Vigilance) indices were monitored during testing. Comparisons indicate that the effects of tyrosine ingestion include: (1) overall increase in pulse pressure (LBNP typically reduces pulse pressure); (2) an increase in P300 amplitude (indicating increased cognitive activity) when participating in the odd-ball task; and (3) a non-significant increase (22 percent) in LBNP tolerance among subjects who could not withstand LBNP for the full 30 minute period. Results of this study indicate that elevated blood plasma tyrosine levels reduce physiological decrements caused by LBNP stress. GRA

**N90-24712#** Illinois Univ., Urbana. Lab. of Immunophysiology.  
**RECIPROCAL RELATIONSHIPS BETWEEN THE IMMUNE AND CENTRAL NERVOUS SYSTEM** Annual Report

KEITH W. KELLEY and ROBERT DANTZER 1 May 1990 8 p  
(Contract N00014-89-J-1956)  
(AD-A221259) Avail: NTIS HC A02/MF A01 CSCL 06/1

How the neuroendocrine system affects macrophage activation and how products derived from activated macrophages affect animal behavior is investigated. It was shown that interferon-lambda effectively counteracts the suppression in the synthesis of macrophage-derived tumor necrosis factors-alpha caused by both glucocorticoids and transforming growth factor beta-2. Furthermore, the decline in synthesis of TNF-a and secretion of superoxide anion that occurs in macrophages from aged rats can be significantly reversed by syngeneic pituitary grafts. Macrophage products are also responsible for some aspects of sickness behavior, as defined by peripheral and central injections of interleukin-1 inducing conditioned taste aversion in both endotoxin sensitive and resistant mice. Indomethacin and aspirin do not block the effects of IL-1 on conditioned taste aversion, but they both



inhibit the reductions in social exploration and schedule-controlled behavior of rats injected peripherally with IL-1. These data support the idea that macrophage products are responsible for behavioral symptoms of illness following a bacterial infection, and that macrophage activation is regulated by hormones from the pituitary gland. GRA

## 52

## AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

## A90-38929

**RELATIONSHIPS BETWEEN ORIENTATION, MOVEMENT AND POSTURE IN WEIGHTLESSNESS - PRELIMINARY ETHOLOGICAL OBSERVATIONS**

CAROLE TAFFORIN (Toulouse III, Universite, France) Acta Astronautica (ISSN 0094-5765), vol. 21, April 1990, p. 271-280. Research supported by CNES. refs

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An ethological method has been used to describe the overall spontaneous behavior of astronauts as seen from video recordings made during space flights. The astronaut orientates himself with reference to the Space Shuttle's internal structure; the increase of visual activity confirms the choice of the retinal vertical as frame of reference. The main data reveal a decrease in motor stereotypies by the diversity of motor acts observed and the importance of the link between orientation and posture described as follows: slightly inclined forward position, with legs flexed at about 135 deg. There appears to be a new organization of the cognitive image of the body scheme, the missing vestibular information being supplied by peripheral vision instead which could play a role in the astronaut's perception of his own movement.

Author

## A90-39321#

**STUDY OF ACUTE HYPOXIC EFFECT ON HUMAN PERFORMANCE UNDER AEROSPACE CONDITIONS**

JINGXUE ZHANG (Institute of Space Medico-Engineering, Beijing, People's Republic of China) et al. Chinese Society of Astronautics, Journal (ISSN 1000-1328), no. 3, 1989, p. 65-70. In Chinese, with abstract in English. refs

Eighty-four young men and laboratory personnel were tested in a decompression chamber at altitudes of 1500, 2500, 3000, 4000, 5000, and 6000 m and stayed for 60 minutes. Multiple indices for performance tests such as numerical memory, auditory vigilance, and manual tracking skill were examined. Comprehensive evaluations were carried out by the application of fuzzy-set theory in the processing of five fundamental performance indices.

Author

## A90-39642

**RAPID DECOMPRESSION TO 50,000 FEET - EFFECT ON HEART RATE RESPONSE**

C. S. CHOPP, J. B. BOMAR, JR., R. M. HARDING, R. D. HOLDEN, and D. H. BAUER (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, July 1990, p. 604-608. refs

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The effects of rapid decompression (RD) and positive pressure breathing (PPB) during and after from 6096 to 15,239 m in a hypobaric chamber, on the heart rate (HR) were investigated. Subjects breathed either the Aviators' Breathing Oxygen (ABO, which is 95 percent O<sub>2</sub>) or 93 percent oxygen, and their interbeat (R-R) intervals were recorded at two regulator settings: dilution and nondilution. Additional experiments were performed to separate the anxiety, hypoxia, and PPB components of RD. Most subjects showed an increased HR and reduced HR variability immediately

after the onset of RD; after the RD exposure continued, the HR began to decline and the HR variability increased. It was found that anxiety had the greatest effect on HR. No consistent change in the HR was found due to the substitution of 93 percent O<sub>2</sub> for ABO. I.S.

## A90-39643

**HIGH +GZ CENTRIFUGE TRAINING - THE ELECTROCARDIOGRAPHIC RESPONSE TO +GZ-INDUCED LOSS OF CONSCIOUSNESS**

ANGELA M. WHINNERY (USAF, McGuire AFB, NJ), JAMES E. WHINNERY (U.S. Navy, Naval Air Development Center, Warminster, PA), and JAMES R. HICKMAN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, July 1990, p. 609-614. refs

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The effect of +Gz-induced loss of consciousness (G-LOC) on the autonomic control of the heart was investigated in 59 subjects undergoing centrifuge +Gz training, with the +Gz training profiles including gradual (0.1 G/s) and rapid (about 6 G/s) exposures to levels as high as +9 Gz. The electrocardiographic rate and rhythm disturbances were evaluated during each of these training profiles. Both rate and rhythm disturbances associated with the +Gz stress exposures were found in 73 percent of trainees. Significant ectopy could be related only to +Gz stress and not to G-LOC (which, on the average, lasted 12.6 sec). The results suggest that G-LOC does not alter the electrocardiographic response to Gz stress. I.S.

## A90-39644\* Essex Corp., Orlando, FL.

**DIFFERENTIAL EFFECTS OF SCOPOLAMINE AND AMPHETAMINE ON MICROCOMPUTER-BASED PERFORMANCE TESTS**

ROBERT S. KENNEDY, ROBERT C. ODENHEIMER, DENNIS R. BALTZLEY, WILLIAM P. DUNLAP, and CHARLES D. WOOD (Essex Corp., Orlando, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, July 1990, p. 615-621. refs

(Contract NAS9-17326)

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The effects of four weekly treatments with scopolamine (1.0 mg) and d-amphetamine (10 mg), separately or in combination, on human performance were investigated in 16 subjects undergoing nine performance tests from a menu of microcomputer-based tests administered after the treatment. It was d-amphetamine treatment that enhanced the results of motor and perceptual speed tests, while scopolamine had no effect on these tests. Two of the five cognitive tests showed reductions with scopolamine. The effects of scopolamine in this and other studies are considered in terms of a model which implies that the magnitude of the performance deficit depends on the performance type and the dosage level of the drug. I.S.

## A90-39645

**VESTIBULO-OCULAR RESPONSES IN MAN TO +GZ HYPERGRAVITY**

J. T. MARCUS (TNO, Instituut voor Zintuigfysiologie TNO, Soesterberg, Netherlands) and C. R. VAN HOLTEN (Royal Netherlands Air Force, Twente AFB, Netherlands) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, July 1990, p. 631-635. refs

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The influence of high +Gz gravito-inertial force on the vestibular system in man was investigated in a 4-m centrifuge with a freely swinging gondola. The Gz profile was: acceleration +0.2 Gz/s, +3 Gz sustained for 3 min, and deceleration -0.2 Gz/s. The subject was exposed to this profile under two conditions in randomized order: facing forward and facing backward. Under these conditions, the effective angular velocity in the plane of the vertical semicircular canals is opposed. Adding the slow phase velocity responses from these conditions yields the Gz effect only; subtracting yields the angular velocity effect only. Vertical vestibular nystagmus was analyzed in five subjects. Results indicate that +3 Gz induced a

subject-dependent vertical nystagmus with slow phase downwards. The average amplitude of this nystagmus reached a maximum of 27 deg/s at 16 s from G onset, and was 11 deg/s after 3 min of sustained +3 Gz. The vestibular stimulation by +Gz could result in false subjective perception of attitude, and play a major role in spatial disorientation in flight. Author

**A90-39648****AVIATORS INTOXICATED BY INHALATION OF JP-5 FUEL VAPORS**

HENRY O. PORTER (U.S. Navy, Naval Hospital, Bethesda, MD) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, July 1990, p. 654-656. refs  
Copyright

This case of intoxication of two aviators by inhalation of JP-5 fuel vapors emphasizes a dangerous safety hazard. One or both aviators experienced burning eyes, nausea, fatigue, impairment of eye-hand coordination, euphoria, and memory defects when their cockpit became overwhelmed with the odor of JP-5 fuel. Physical and laboratory examinations were normal except for their ill appearance, conjunctivitis, and mild hypertension, which resolved without sequelae. Exposure to JP-5 fuel vapor occurs frequently, particularly after acrobatic flight in some aircraft. The neurologic effects and insidious nature of intoxication makes continued operation under such conditions extremely hazardous. The following is recommended: in the event the odor of JP-5 is detected in the cockpit, serious consideration should be given to terminating the flight, using precautionary emergency landing procedures and 100 percent O<sub>2</sub>. Author

**A90-39649****RECURRENT SINUSITIS AND IMPAIRMENT OF EUSTACHIAN TUBE FUNCTION IN AIR PASSENGERS AND CREW**

MICHAEL MOSER and GERALD WOLF (Graz, Universitaet, Austria) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, July 1990, p. 662-665. refs  
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Results of medical examination (rhinoscopy, tympanometry, computer-assisted tomography, tests with the Politzer tube, and the Valsalva maneuver) are presented for 69 patients with recurrent sinusitis, an impairment of tubular function, and complaints of pressure equilibration disorders during flight. The results point to consequences in the selection process of pilot candidates. It was found that the Valsalva maneuver with otoscopic visualization of the excursion of the eardrum is the most reliable test of tubular function. However, in the assessment of tubular function, tympanometry should always be performed, especially for documentation. I.S.

**A90-40750\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**HORMONAL REGULATION OF FLUID AND ELECTROLYTES DURING PROLONGED BED REST - IMPLICATIONS FOR MICROGRAVITY**

JOHN E. GREENLEAF (NASA, Ames Research Center, Moffett Field, CA) IN: Hormonal regulation of fluid and electrolytes. New York, Plenum Publishing Corp., 1989, p. 215-232. refs  
Copyright

The results of studies on the physiological changes of body fluids and electrolytes during bed rest with and without exercise training are overviewed to determine the effect of exercise and to assess the role of hormonal regulation in fluid-electrolyte responses to hypogravity. Special attention is given to fluid shifts observed in spacecraft personnel during space missions. It is concluded that, despite an apparent uncoupling of prominent hormonal interactions during bed-rest deconditioning (and, possibly, during microgravity), the exercise-training-induced hypervolemia helps to counter the hypohydrostatic-induced dehydration. Thus, it was found that, after nearly a year of spaceflight during which one cosmonaut exercised for about 4 hr per day, the water balance and physiological functioning were not disturbed significantly. I.S.

**A90-42288****EFFECTS OF PYRIDOSTIGMINE BROMIDE ON IN-FLIGHT AIRCREW PERFORMANCE**

VALERIE J. GAWRON, JOHN F. BALL (Calspan Corp., Buffalo, NY), SAMUEL G. SCHIFLETT, TIMOTHY SLATER (USAF, School of Aerospace Medicine, Brooks AFB, TX), and JAMES C. MILLER (USAF, Flight Test Center, Edwards AFB, CA) Human Factors (ISSN 0018-7208), vol. 32, Feb. 1990, p. 79-94. Research supported by the U.S. Army. refs  
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The effects of a chemical defense pretreatment drug, pyridostigmine bromide (PB) on in-flight aircrew performance were assessed using the Total In-Flight Simulator (TIFS) aircraft. TIFS was used to supply appropriate control dynamics, handling characteristics, and cockpit instrumentation for a tactical transport airdrop simulation. Twenty-one C-130 pilots flew two familiarization and four data flights. During two data flights PB was given to both members of the aircrew using the dosage regimen of 30 mg/8 h prescribed by the U.S. Air Force surgeon general. The drug was administered using a double-blind technique. The results indicated that (1) aircrews successfully completed their assigned mission, (2) airdrop inaccuracies and navigation errors in time and distance were not specifically related to PB, (3) performance and crew coordination were not affected by PB, (4) PB and pilot/copilot order significantly affected copilot tasks, and (5) subjects and observers did not discriminate beyond chance between PB and placebo conditions. Author

**N90-23865#** Army Research Inst. of Environmental Medicine, Natick, MA. Exercise Physiology Div.

**PHYSIOLOGICAL AND PERCEPTUAL RESPONSES TO PROLONGED TREADMILL LOAD CARRIAGE Final Report, May 1988 - Nov. 1989**

JOHN F. PATTON, JOHN KASZUBA, ROBERT P. MELLO, and KATY L. REYNOLDS Feb. 1990 45 p  
(Contract DA PROJ. 3E1-62787-A-879)  
(AD-A218809; USARIEM-T11-90) Avail: NTIS HC A03/MF A01 CSCL 06/10

The objectives were to: determine the physiological and perceptual responses to prolonged, level treadmill walking (fixed distance of 12 km) at speeds of 3.96, 4.86, and 5.76 km/hr, unloaded (clothing wt of 5.2 kg) and with external loads (load carriage equipment + backpack) of 31.5 and 49.4 kg; determine the ability of subjects to perform high intensity, anaerobic exercise (Wingate test) immediately after load carriage; and compare the energy cost and perceptual responses of carrying the standard external frame pack to that of the new internal system. Fifteen male subjects performed nine load carriage trials with an external frame pack (ALICE) and two trials with an internal frame pack (IIFS) in random order over a 7 week period. The results show that: energy cost during prolonged load-carriage is not constant but increases significantly over time at relative intensities below 30 percent VO<sub>2</sub>max; the load-carriage conditions were not sufficient to cause fatigue as assessed by blood lactate levels and maximal power outputs; and the two load-carriage systems studied did not differ as to their effects on physiological and perceptual responses to prolonged treadmill walking. GRA

**N90-23866#** Navy Experimental Diving Unit, Panama City, FL.

**FIELD MANAGEMENT OF ACCIDENTAL HYPOTHERMIA DURING DIVING Final Report**

JOHN A. STERBA Jan. 1990 29 p  
(AD-A219560; NEDU-1-90) Avail: NTIS HC A03/MF A01 CSCL 06/10

Hypothermia of both the extremities and the body core continues to be a major problem in cold water diving. Presently, extremity hypothermia of the hands limits cold water diving exposure more so than body core hypothermia. Painful or numb fingers decrease dexterity, safety, work capacity, and increase the risk of developing nonfreezing cold injury (NFCI), which is reviewed. Levels of body core hypothermia, based on rectal core temperature, are mild (35 to 32), moderate (32 to 28), and severe hypothermia (below 28 C). As it relates to cold water diving, the pathophysiology

of immersion and mild to severe hypothermia is reviewed including thermoregulation and effects on organ systems. The diving response, composed of bradycardia and peripheral vasoconstriction, has been shown in man to not prolong breath-holding time, or influence alveolar gas exchange, such as oxygen consumption. Survival from cold water near-drowning may be more dependent on hypothermia than previously recognized. The predisposing factors leading to hypothermia during diving operations are discussed. The determination of body core temperature from various sites including new radio pill telemetry is reviewed. The levels of hypothermia by physical exam findings are reviewed in detail. The field treatment of hypothermia is discussed with attention to a review of the literature, recent research, and first aid management guidelines. The prevention of hypothermia during diving operations and current diving medicine research in the active thermal protection of free swimming divers is reviewed. GRA

**N90-23867#** Indiana Univ., Bloomington. Hearing and Communication Lab.

**PERCEPTION OF COMPLEX AUDITORY PATTERNS Final Report, 1 Sep. 1987 - 30 Sep. 1989**

CHARLES S. WATSON and GARY R. KIDD Nov. 1989 21 p (Contract AF-AFOSR-0300-87; AF PROJ. 2313) (AD-A219626; AFOSR-90-0301TR) Avail: NTIS HC A02/MF A01 CSCL 06/4

The results of research are described in four areas: the perception of complex sounds, including tonal sequences, multidimensional complex sounds, and Gaussian noise; information integration; multi-stage decision making; and studies of the relation between auditory abilities measured with speech and nonspeech stimuli. Major accomplishments during this funding period include: the discovery of the proportion-of-the-total-duration (PTD) principle: Each individual component of a complex sound is resolved with an accuracy that is a function of its proportion of the total duration of the sound; even small degrees of logarithmic frequency transposition of tonal patterns severely degrades the detectability of pattern changes in novel sequences, but not in familiar sequences; temporal integration of auditory information is limited by two distinct types of internal noise, one that is added at the periphery before a decision statistic is formed, and 'central', or post-decision, noise; the development of a theory that incorporates these limiting factors; and the completion and publication of studies of categorical perception for speech and non-speech sounds, demonstrating that enhanced discrimination performance in the region of certain categorical boundaries does not reflect either hard-wired feature detectors in the auditory nervous system, nor psychoacoustic boundaries determined by acoustic peculiarities of complex waveforms. GRA

**N90-23868#** School of Aerospace Medicine, Brooks AFB, TX. Radiation Sciences Div.

**MODEL FOR PREDICTING THE EFFECTS OF LASER EXPOSURES AND EYE PROTECTION ON VISION Interim Report, Jan. 1989 - Jan. 1990**

ARTHUR R. MENENDEZ and PETER A. SMITH (Royal Air Force Inst. of Aviation Medicine, Farnborough, England ) Jan. 1990 14 p (Contract AF PROJ. 7757) (AD-A219697; USAFSAM-PROC-89-26) Avail: NTIS HC A03/MF A01 CSCL 06/10

Laser safety standards and eye protection (filters) are designed to limit ocular exposures to prevent retinal lesions, yet eyesafe laser exposures can disrupt vision by causing glare and flashblindness. Protective filters can have opposing effects on vision function. The protective filters reduce laser exposures but also reduce task luminance and contrast. Filters alone may interfere with vision and consequently reduce work safety and performance. It is therefore important to be able to predict the effects of both laser exposures and protective filters to assess trade-offs between protection and visual function. This paper briefly reviews the methods, concepts, and experimental database used in the laboratory to predict laser, filter, and laser-plus-filter effects on

tasks involving visual detection. The modeling approach uses estimates of the spatial distribution of light in the retinal image of the laser source to predict glare, flashblindness, and retinal lesions. It also considers the non-uniformity of visual abilities across the retina in predicting the impact of a laser exposure of a given size and retinal location. The proposed modeling approach provides a general framework for the interpretation, integration, and application of data from various studies. It has the potential to assess the effects of lasers and eye-protection devices on vision, and to guide visual simulations of the appearance of displays and scenes after laser exposures. GRA

**N90-23869#** Wisconsin Univ., Madison. Dept. of Preventive Medicine.

**EFFECTS OF HIGH ALTITUDE HYPOXIA ON LUNG AND CHEST WALL FUNCTION DURING EXERCISE Midterm Report, 30 Jun. 1988 - 30 Dec. 1989**

JEROME A. DEMPSEY 27 Jan. 1990 9 p (Contract DAMD17-88-C-8053; DA PROJ. 3M1-62787-A-879) (AD-A219814) Avail: NTIS HC A02/MF A01 CSCL 06/10

The mechanical limitations to normal exercise in healthy persons was defined more precisely than ever before. In most instances in the normal or moderately fit individual, the ventilatory requirement is such that mechanical limitations are barely reached on expiration but not to inspiratory muscles in heavy exercise and fatigue of respiratory muscles is not a factor. The greater the level of physical fitness, the greater the maximum exercise load the greater the probability that mechanical limitation to flow on expiration and to pressure generation by inspiratory muscles on inspiration will be achieved over a substantial part of the tidal breath. This results in an even higher oxygen cost of respiration in these subjects that reach mechanical limitation. On the other hand, it is only in very rare instances that we observed that this mechanical limitation interfered with the provision of sufficient alveolar hyperventilation in these subjects to achieve adequate gas exchange and arterial oxygenation and acid-base regulation. GRA

**N90-23870#** Army Aeromedical Research Lab., Fort Rucker, AL. Biodynamics Research Div.

**EVALUATION OF THE HEAD INJURY HAZARD DURING MILITARY PARACHUTING Final Report**

CHARLES R. PASCHAL, JR., RONALD W. PALMER, DENNIS F. SHANAHAN, and JOSEPH L. HALEY, JR. Mar. 1990 53 p (Contract DA PROJ. 3E1-62787-A8-78) (AD-A220724; USAARL-90-6) Avail: NTIS HC A04/MF A01 CSCL 01/2

The incidence of head injury during U.S. Army airborne training and airborne operations has doubled in recent years. A number of factors are known to contribute to head injuries incurred during airborne training/operations. These factors include the small amount of impact protection provided by the Personal Armor System for Ground Troops (PASGT) helmet, shortcomings in training procedures, and failure of trained airborne troops to follow proper procedures when jumping. Other factors are involved as well. This report shows, with relatively little modification, the impact protection and retention characteristics of the PASGT airborne helmet can be significantly improved. Also, this report evaluates a number of factors present in airborne training and operational environments that contribute to head injury and explains how training and operational procedures can be modified to reduce the incidence of repeated headstrikes and subsequent serious head injuries. GRA

**N90-23871#** North Dakota State Univ., Fargo. Dept. of Electrical and Electronics Engineering.

**DURIP-INSTRUMENTATION FOR RECORDING AND ANALYZING MULTIPLE INPUT/OUTPUT SACCADIC EYE MOVEMENT NEUROSENSORY CONTROL Final Technical Report, 1 Dec. 1988 - 30 Nov. 1989**

JOHN ENDERLE 29 Jan. 1990 19 p (Contract AF-AFOSR-0092-89; AF PROJ. 3842)



(AD-A219905; AFOSR-90-0342TR) Avail: NTIS HC A03/MF A01 CSCL 06/4

To investigate multiple input-multiple output saccadic eye movement neurosensory control, both three-dimensional eye movement data are recorded and analyzed. The purpose of this grant is funding computer equipment for analysis of head and saccadic eye movement data, to describe the neurosensory control mechanism response from combined visual, auditory and vestibular stimuli during enhancement and inhibitory modes. The ultimate goal is to enhance the understanding of how the brain integrates and controls neurosensory information. Data analysis is carried out in both the time and frequency domain. The system identification technique is used for parameter and control estimation from the data collected. Significant advances on eye rectus muscle model development and a neural network for saccades have been made. It should be noted that the use of the equipment purchased with this grant will continue in the future. GRA

**N90-23872#** Central Inst. for the Deaf, Saint Louis, MO.  
**AUDITORY PERCEPTION OF COMPLEX SOUNDS Final Report, 1 Sep. 1987 - 31 Dec. 1989**

IRA J. HIRSH 6 Mar. 1990 3 p  
(Contract AF-AFOSR-0382-87; AF PROJ. 2313)  
(AD-A219927; AFOSR-90-0360TR) Avail: NTIS HC A01/MF A01 CSCL 06/4

Experiments on auditory perception of temporal interval, pitch, and timbre are outlined. Reference to more detailed articles in press are provided. Articles on auditory timing have appeared in perception and psychophysics. GRA

**N90-23873#** Zurich Univ. (Switzerland). Neurology Clinic.  
**NEUROTRANSMITTER AND PEPTIDE LOCALIZATION IN HUMAN BRAIN Final Report, 1 May 1986 - 30 Apr. 1989**

VICTORIA CHAN-PALAY 13 Mar. 1990 6 p  
(Contract AF-AFOSR-0176-86; AF PROJ. 2312)  
(AD-A219964; AFOSR-90-0358TR) Avail: NTIS HC A02/MF A01 CSCL 06/4

Studies utilizing human brain tissue examined the colocalization of neurotransmitters using immunocytochemical and in vitro hybridization techniques. Results have shown the coexistence of somatostatin and neuropeptide Y in the hippocampus, and galanin and acetylcholine in the human forebrain. GRA

**N90-23874#** Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Human Systems Div.

**BRAIN STEM EVOKED RESPONSES IN ALTERED G ENVIRONMENTS Interim Report, Jan. 1985 - Apr. 1986**

GLENN F. WILSON, RALPH J. LUCIANI, DAVID A. RATINO, LORETTA L. FLOYD, and LOUIS E. RODRIGUEZ Sep. 1989 16 p

(Contract AF PROJ. 7184)  
(AD-A220097; AAMRL-TR-89-016) Avail: NTIS HC A03/MF A01 CSCL 05/8

Due to the importance of the vestibular system in both ground-based and space-based motion sickness, a method of measuring its activity in intact humans is desirable. Since the gravito-inertial end-organ receptors of the vestibular and auditory systems are in close proximity and share common peripheral structures, it is hypothesized that changes in the neuroelectrical activity of the otolith pathway affected by gravito-inertial off-loading could possibly influence nerve conduction in the auditory system. This could subsequently be measured by recording changes in the brain stem evoked response (BSER), providing an indirect measure of vestibular activity. BSERs were recorded from ten subjects under the cardinal static environments of +1 and -1 Gx, Gy, and Gz. No changes were found in the vestibular end organs and the auditory system were not found to interact under the conditions of this study. GRA

**N90-23875#** Army Natick Research and Development Command, MA. Soldier Science Directorate.

**A LABORATORY STUDY OF THE EFFECTS OF DIET AND BRIGHT LIGHT COUNTERMEASURES TO JET LAG Final Report, Apr. 1988 - Jun. 1989**

M. L. MOLINE, C. P. POLLAK, S. ZENDELL (New York Hospital-Cornell Medical Center, NY.), L. S. LESTER, C. A. SALTER, and E. HIRSCH Mar. 1990 97 p  
(Contract DAAK60-88-C-0100; DA PROJ. 1L1-62786-AH-99)  
(AD-A220148; NATICK-TR-90-/024) Avail: NTIS HC A05/MF A01 CSCL 06/10

The ability of diet or bright light to prevent or alleviate jet lag was tested by simulating a 6-hour easterly time zone shift. Twenty-three male Marines lived in individual, time-isolation apartments for 15 consecutive days. Diet group subjects were put on a popularized jet lag diet (high protein breakfast, high carbohydrate dinners, scheduled caffeine consumption) for 4 days prior to the shift. Light group subjects were exposed to bright (2500 lux), full-spectrum light on the first 4 mornings after the shift. Control group subjects were maintained on a mixed nutrient, balanced diet and were exposed only to ambient light. All of the subjects experienced jet lag as evidenced by disruption in sleep patterns and body temperature rhythms. Decrements in mood, performance, and levels of physical activity were also noted. The jet lag diet actually worsened sleep and did not lessen or promote recovery from other jet lag symptoms. The bright light treatment showed the most promise for future use in that, after 2 to 3 treatments, Light group subjects tended to be more alert and happier than before the shift as well as more alert and happier than Diet and Control group subjects. However, the light regimen hindered temperature rhythm resynchronization and sleep. Additional research is needed to determine if these undesirable effects can be reduced or eliminated by modifying the intensity of the bright light and/or the timing of the treatment. GRA

**N90-23876#** BBN Systems and Technologies Corp., Canoga Park, CA.

**ANALYSES OF THE PREDICTABILITY OF NOISE-INDUCED SLEEP DISTURBANCE Final Report, 23 Feb. - 23 Dec. 1989**

KARL S. PEARSONS, DAVID S. BARBER, and BARBARA G. TABACHNICK 17 Jan. 1990 86 p  
(Contract F33615-86-C-0530; AF PROJ. 3037)  
(AD-A220156; BBN-7131; HSD-TR-89-029) Avail: NTIS HC A05/MF A01 CSCL 06/10

A summary of the analyses performed on 21 studies concerning the effects of noise on sleep is provided. The analyses were performed in the hope of developing a quantitative predictive model for assessing the effects of aircraft noise exposure on sleep. However, large discrepancies noted between laboratory and field studies precluded the development of such a model. The report includes a summary of the studies reviewed, the analyses undertaken, and various dose-effect relationships for awakening, and sleep stage change as a function of A-level and sound exposure level (SEL) in laboratory and field environments. The analyses include hierarchical multivariate regressions of the data of reviewed studies. Since a model for sleep disturbance could not be developed from available information, suggestions for studies to acquire the data are provided. GRA

**N90-23877\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 336)**

May 1990 49 p  
(NASA-SP-7011(336); NAS 1.21:7011(336)) Avail: NTIS HC A03; NTIS standing order as PB90-912300, \$11.50 domestic, \$23.00 foreign CSCL 06/16

This bibliography lists 111 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during April 1990. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance. Author

**N90-24713#** Universal Energy Systems, Inc., Dayton, OH.  
**AN INVESTIGATION INTO TECHNIQUES FOR LANDMARK IDENTIFICATION OF 3D IMAGES OF HUMAN SUBJECTS, PHASE 1**

RANDY BETH POLLOCK (Wright State Univ., Dayton, OH.) Aug. 1989 18 p  
 (Contract F49620-88-C-0053; AF PROJ. 7184)  
 (AD-A218614; AAMRL-SR-90-500) Avail: NTIS HC A03/MF A01 CSDL 23/2

Anthropometric data have been used by the Air Force for many years to help in the design of clothing, equipment, cockpits, etc. The use of anthropometric statistics enables designers to provide a better-fitting product and ensure that the people who will be using the equipment are physically able to do so. The Human Engineering Division has been exploring the use of 3-dimensional scanning technology to produce a digital representation of the surface of the human head. A vertical stripe of laser light is projected onto a stationary subject as the scanner rotates 360 degrees around him or her, taking video recordings which are converted into digital format. Although the data collected in this way are much more complete than was possible using traditional methods, techniques have not yet been developed to easily analyze and use this type of data. Several approaches to landmark identification using artificial intelligence methodologies were investigated. A blackboard architecture was identified as the most promising approach. Several prototype modules were developed to generate and evaluate hypotheses regarding the positions of the landmarks on 3-D digital images. These were tested on a sample of 20 subjects and the results were sufficiently encouraging to warrant further work. The design of a blackboard system was begun, including components utilizing other technologies such as neural networks and constraint networks.

GRA

**N90-24714#** California Univ., Irvine.  
**ANALYSIS OF NEURAL SYSTEMS INVOLVED IN MODULATION OF MEMORY STORAGE** Final Technical Report, 1 Jun. 1987 - 31 May 1990

JAMES L. MCGAUGH 1990 6 p  
 (Contract N00014-87-K-0518)  
 (AD-A220230) Avail: NTIS HC A02/MF A01 CSDL 06/4

The research supported by this contract over the past three years examined the role of neuromodulatory systems in the modulation of memory storage processes. The research was based on extensive evidence from previous studies indicated that memory storage processes are modulated by neuromodulatory systems activated by learning experiences. It is well documented that, in laboratory animals, retention is modified by posttraining administration of stress-related hormones as well as neurotransmitters and drugs that influence hormonal and neurotransmitter systems. Research in the laboratory has examined the effects of treatments affecting adrenergic, cholinergic, opioid peptidergic and, most recently, GABAergic systems. Previous studies indicated that these neuromodulatory systems may influence memory through effects involving the amygdaloid complex. More generally, the findings of preliminary studies suggested that the amygdala may serve to integrate the effects of neuromodulatory systems on memory storage. The aim of the research supported by this contract was: (1) to increase our understanding of the locus of brain regions involved in the effects, on memory of treatments affecting neuromodulatory systems, and (2) to determine whether treatments affecting memory storage work through a common set of brain systems.

GRA

**N90-24715#** School of Aerospace Medicine, Brooks AFB, TX.  
**DECOMPRESSION SICKNESS AFFECTING THE TEMPOROMANDIBULAR JOINT** Final Report

FREDERICK W. RUDGE 1990 7 p  
 (AD-A220959; USAFSAM-JA-90-6) Avail: NTIS HC A02/MF A01 CSDL 06/10

Three cases of pain-only decompression sickness of the temporomandibular joint following altitude chamber exposure are presented. A detailed interview of each individual revealed no other

joint involvement or other complaints. A careful neurologic examination failed to disclose abnormalities. In each case, the pain resolved completely with recompression, supporting the diagnosis of decompression sickness. Decompression sickness limited to this small joint is extremely rare, and may easily be confused with other causes of joint pain.

GRA

**N90-24716#** Naval Air Development Center, Warminster, PA.  
 Air Vehicle and Crew Systems Technology Dept.  
**RHEOENCEPHALOGRAPHY IN SIMULATED AVIATION ENVIRONMENTAL STRESS** Interim Report - Ph.D. Thesis - Drexel Univ.

BARRY SCOTT SHENDER 1 Jun. 1989 170 p  
 (AD-A221150; NADC-89042-60) Avail: NTIS HC A08/MF A01 CSDL 06/10

The use of electrical impedance plethysmography of the head, or Rheoencephalography (REG), has been demonstrated in a high acceleration stress environment on human volunteer subjects. Acceleration stress was applied in the head-to-foot direction and is referred to as +Gz. The REG instrument divides the cephalic impedance waveform into two components: (1) a baseline impedance signal, Zb, that is referable to the bulk movement of blood in and out of the head, and (2) a pulsatile impedance waveform that is heart beat coincident. The REG waveform also contains information about cerebrospinal fluid (CSF) volume changes and shifts resulting from the application of acceleration stress. Blood and CSF shifts in and out of the cranial and spinal compartments impinge directly upon the overall function of the central nervous system. The high acceleration environment provides an ideal arena in which to alter cephalic fluid volumes noninvasively in order to obtain basic physiologic knowledge of importance to both aviation and clinical medicine.

GRA

**N90-24717#** Dayton Univ., OH.  
**EFFECTS OF PYRIDOSTIGMINE BROMIDE ON A-10 PILOTS DURING EXECUTION OF A SIMULATED MISSION: PHYSIOLOGY** Interim Report, Jul. 1984 - May 1989

ARTHUR E. HARRIMAN, DAVID C. HUBBARD, REBECCA B. BROOKS, and ROBERT R. WOODRUFF (Air Force Human Resources Lab., Williams AFB, AZ.) Apr. 1990 40 p Prepared in cooperation with Air Force Human Resources Lab., Brooks AFB, TX  
 (AD-A221222; AFHRL-TR-89-24) Avail: NTIS HC A03/MF A01 CSDL 15/6

The physiological results are documented of an experiment that was conducted to determine the effects of pyridostigmine bromide (PB) (30 milligrams, three times per day) on pilot performance and physiology. Both sets of data were collected in an A-10 flight simulator with an Advanced Visual Technology System (AVTS). The subjects were 24 A-10 pilots who were trained on the following simulated tasks over three 55-minute sessions: takeoff, patterns, emergency procedure, and landing; air-to-air refueling; conventional low-angle strafing; and low-level ingress/RED FLAG. Next, during two test sessions, 48 hours apart, the pilots were tested using a double-blind procedure on the same tasks in a PB condition and in a placebo condition. In the two test sessions, 12 of the pilots wore the chemical defense ensemble (CDE) and the other 12 pilots wore standard flight gear (SFG). PB dosages led to reports of 27 symptoms among 12 (50 percent) of the pilots. Under the placebo condition, in contrast, only 5 (20 percent) of the pilots reported a total of 6 symptoms. Analyses of PB effects on physiological functions and on various biobehavioral measures showed suppression of heart rate and a tendency toward increased skin temperature. Besides increasing skin temperature, the CDE tended to increase heart rate, especially during the start of the session.

GRA

**N90-24718#** National Inst. of Health, Bethesda, MD. National Center for Human Genome Research.

**UNDERSTANDING OUR GENETIC INHERITANCE. THE US HUMAN GENOME PROJECT: THE FIRST FIVE YEARS, FY 1991-1995**

Apr. 1990 89 p Prepared in cooperation with US DOE Office of Energy Research, Washington, DC  
(DE90-008240; DOE/ER-0452P) Avail: NTIS HC A05/MF A01

The Human Genome Initiative is a worldwide research effort with the goal of analyzing the structure of human DNA and determining the location of the estimated 100,000 human genes. In parallel with this effort, the DNA of a set of model organisms will be studied to provide the comparative information necessary for understanding the functioning of the human genome. The information generated by the human genome project is expected to be the source book for biomedical science in the 21st century and will be of immense benefit to the field of medicine. It will help us to understand and eventually treat many of the more than 4000 genetic diseases that affect mankind, as well as the many multifactorial diseases in which genetic predisposition plays an important role. A centrally coordinated project focused on specific objectives is believed to be the most efficient and least expensive way of obtaining this information. The basic data produced will be collected in electronic databases that will make the information readily accessible on convenient form to all who need it. This report describes the plans for the U.S. human genome project and updates those originally prepared by the Office of Technology Assessment (OTA) and the National Research Council (NRC) in 1988. In the intervening two years, improvements in technology for almost every aspect of genomics research have taken place. As a result, more specific goals can now be set for the project.

DOE

**N90-24976\*# Alabama Univ., Tuscaloosa.**  
**NONINVASIVE ESTIMATION OF FLUID SHIFTS BETWEEN**  
**BODY COMPARTMENTS BY MEASUREMENT OF**  
**BIOELECTRIC CHARACTERISTICS Final Report**

PHILLIP A. BISHOP In Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 1 15 p Dec. 1989  
Avail: NTIS HC A09/MF A02 CSCL 06/16

Previous research has established that bioelectrical characteristics of the human body reflect fluid status to some extent. It has been previously assumed that changes in electrical resistance (R) and reactance (X) are associated with changes in total body water (TBW). The purpose of the present pilot investigation was to assess the correspondence between body R and X and changes in estimated TBW and plasma volume during a period of bedrest (simulated weightlessness). R and X were measured pre-, during, and post- a 13 day bedrest status. Although a clear relationship was not elucidated, evidence was found suggesting that R and X reflect plasma volume rather than TBW. Indirect evidence provided by previous studies which investigated other aspects of the electrical/fluid relationship, also suggests the independence of TBW and electrical properties. With further research, a bioelectrical technique for noninvasively tracking fluid changes consequent to space flight may be developed. Author

**N90-24978\*# Alma Coll., MI. Dept. of Exercise and Health Science.**

**EFFECT OF FLUID COUNTERMEASURES OF VARYING**  
**OSMOLARITY ON CARDIOVASCULAR RESPONSES TO**  
**ORTHOSTATIC STRESS Final Report**

JOHN E. DAVIS In Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 1 14 p Dec. 1989  
Avail: NTIS HC A09/MF A02 CSCL 06/16

Current operational procedures for shuttle crewmembers include the ingestion of a fluid countermeasure approximately 2 hours before reentry into the earth's gravitational field. The ingestion of the fluid countermeasure is thought to restore plasma volume and improve orthostatic responses upon reentry. The present countermeasure consists of ingesting salt tablets and water to achieve an isotonic solution. It has yet to be determined whether this is the optimal drink to restore orthostatic tolerance. It is also not known whether the drink solution is effective in increasing plasma volume. The purpose here is to evaluate the effectiveness of drink solutions of different osmolality on restoring plasma volume and orthostatic responses. A hypertonic drink solution was more effective in restoring plasma volume after dehydration than an

isotonic solution. However, there were no differences in their effects on an orthostatic challenge. These data suggest that the plasma volume differences produced in this study were not sufficient to produce differences in the cardiovascular responses to an orthostatic challenge, or there are other changes that occur during space flight that are more important in determining orthostatic intolerance. Author

**N90-24989\*# Fordham Univ., New York, NY. Div. of Science and Mathematics.**

**THE EFFECTS OF SIMULATED HYPOGRAVITY ON MURINE**  
**BONE MARROW CELLS**

DESALES LAWLESS In Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 2 15 p Dec. 1989  
Avail: NTIS HC-A08/MF A01 CSCL 06/16

Mouse bone marrow cells grown in complete medium at unit gravity were compared with a similar population cultured in conditions that mimic some aspects of microgravity. After the cells adjusted to the conditions that simulated microgravity, they proliferated as fetal or oncogenic populations; their numbers doubled in twelve hour periods. Differentiated subpopulations were depleted from the heterogeneous mixture with time and the undifferentiated hematopoietic stem cells increased in numbers. The cells in the control groups in unit gravity and those in the bioreactors in conditions of microgravity were monitored under a number of parameters. Each were phenotyped as to cell surface antigens using a panel of monoclonal antibodies and flow cytometry. Other parameters compared included: pH, glucose uptake, oxygen consumption and carbon-dioxide production. Nuclear DNA was monitored by flow cytometry. Functional responses were studied by mitogenic stimulation by various lectins. The importance of these findings should have relevance to the space program. Cells should behave predictably in zero gravity; specific populations can be eliminated from diverse populations and other populations isolated. The availability of stem cell populations will enhance both bone marrow and gene transplant programs. Stem cells will permit developmental biologists study the paths of hematopoiesis. Author

**N90-24993\*# Texas Univ., Galveston. Dept. of Pharmacology and Toxicology.**

**CONSERVATION OF BODY CALCIUM BY INCREASED**  
**DIETARY INTAKE OF POTASSIUM: A POTENTIAL MEASURE**  
**TO REDUCE THE OSTEOPOROSIS PROCESS DURING**  
**PROLONGED EXPOSURE TO MICROGRAVITY Final Report**

BOHDAN R. NECHAY In Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 2 6 p Dec. 1989  
Avail: NTIS HC A08/MF A01 CSCL 06/16

During the 1988 NASA Summer Faculty Fellowship Program, it was proposed that the loss of skeletal calcium upon prolonged exposure to microgravity could be explained, in part, by a renal maladjustment characterized by an increased urinary excretion of calcium. It was theorized that because the conservation of body fluids and electrolytes depends upon the energy of adenosine triphosphate and enzymes that control the use of its energy for renal ion transport, an induction of renal sodium and potassium-dependent adenosine triphosphatase (Na + K ATPase) by oral loading with potassium would increase the reabsorption of sodium directly and that of calcium indirectly, leading to improved hydration and to reduced calcium loss. Preliminary studies showed the following. Rats drinking water containing 0.2 M potassium chloride for six to 13 days excreted in urine 22 mEq of calcium and 135 mEq of sodium per 100 grams of body weight per day. The corresponding values for control rats drinking tap water were 43 mEq and 269 mEq respectively. Renal Na + K ATPase activity in potassium loaded rats was higher than in controls. Thus, oral potassium loading resulted in increased Na + K ATPase activity and diminished urinary excretion of calcium and of sodium as predicted by the hypothesis. An extension of these studies to humans has the potential of resulting in development of harmless, non-invasive, drug-free, convenient measures to reduce bone loss and other electrolyte and fluid problems in space travelers exposed to prolonged periods of microgravity. Author



## BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**A90-38858\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**PERCEPTUAL ISSUES IN SCIENTIFIC VISUALIZATION**

MARY K. KAISER (NASA, Ames Research Center, Moffett Field, CA) and DENNIS R. PROFFITT (Virginia, University, Charlottesville) IN: Three-dimensional visualization and display technologies; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 205-211. refs

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In order to develop effective tools for scientific visualization, consideration must be given to the perceptual competencies, limitations, and biases of the human operator. Perceptual psychology has amassed a rich body of research on these issues and can lend insight to the development of visualization techniques. Within a perceptual psychological framework, the computer display screen can best be thought of as a special kind of impoverished visual environment. Guidelines can be gleaned from the psychological literature to help visualization tool designers avoid ambiguities and/or illusions in the resulting data displays. Author

**A90-38861\***

**ALTERNATIVE REPRESENTATIONS OF VISUAL SPACE**

ARIES ARDITI (Vision Research Laboratory, New York) IN: Three-dimensional visualization and display technologies; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 242-245. refs

(Contract NCC2-541; NIH-AG-06551)

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This paper discusses a method for delineating and testing hypotheses about the relationship between the retinal images and the three-dimensional visual space they serve. The method may be used under the conditions of changing eye position, occlusion by structures that are part of or are mounted on the observer, occlusions by environmental objects, defects of the visual field, and variables that alter the focus of environmental imagery on the retinas. Author

**A90-38864** IBM Watson Research Center, Yorktown Heights, NY.

**HUMAN VISION, VISUAL PROCESSING, AND DIGITAL DISPLAY; PROCEEDINGS OF THE MEETING, LOS ANGELES, CA, JAN. 18-20, 1989**

BERNICE E. ROGOWITZ, ED. (IBM Thomas J. Watson Research Center, Yorktown Heights, NY) Meeting sponsored by SPIE, Society for Imaging Science and Technology, JPL, et al. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 1077), 1989, 401 p. For individual items see A90-38865 to A90-38872.

(SPIE-1077) Copyright

Various papers on human vision, visual processing, and digital display are presented. The general topics considered include: physics and psychophysics of displayed information; visual performance and image quality; vision-based algorithms for image processing; visual sampling, compression, and representation; texture, pattern, and motion; color perception, coding, and representation. Some individual topics discussed are: respective fields and visual representations; psychophysical rating of image compression techniques; new paradigm for testing human and machine motion perception; motion perception model with interactions between spatial frequency channels; application of visual psychophysics to the design of video systems for use in

space; unified model for human color perception and visual adaptation. C.D.

**A90-38865\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**RECEPTIVE FIELDS AND VISUAL REPRESENTATIONS**

ANDREW B. WATSON (NASA, Ames Research Center, Moffett Field, CA) IN: Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 190-197. refs

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Efficient representation of images for human use requires an understanding of how the brain processes and represents visual information. Spatial imagery is represented in the brain in the receptive fields of visual neurons. Models of these neurons lead to models of image fidelity, and to digital implementations of these neural codes. This approach will be illustrated by two example codes. The advantages and difficulties of this approach will be discussed. Author

**A90-38866\*** California Univ., Santa Cruz.

**PSYCHOPHYSICAL RATING OF IMAGE COMPRESSION TECHNIQUES**

CHARLES S. STEIN, LEWIS E. HITCHNER (California, University, Santa Cruz), and ANDREW B. WATSON (NASA, Ames Research Center, Moffett Field, CA) IN: Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 198-208. refs

Copyright

Image compression schemes abound with little work which compares their bit-rate performance based on subjective fidelity measures. Statistical measures of image fidelity, such as squared error measures, do not necessarily correspond to subjective measures of image fidelity. Most previous comparisons of compression techniques have been based on these statistical measures. A psychophysical method has been used to estimate, for a number of compression techniques, a threshold bit-rate yielding a criterion level of performance in discriminating original and compressed images. The compression techniques studied include block truncation, Laplacian pyramid, block discrete cosine transform, with and without a human visual system scaling, and cortex transform coders. Author

**A90-38868**

**A NEW PARADIGM FOR TESTING HUMAN AND MACHINE MOTION PERCEPTION**

THOMAS V. PAPHOMAS (AT&T Bell Laboratories, Murray Hill, NJ) and ANDREI GOREA (Paris V, Université; CNRS, Laboratoire de Psychologie Expérimentale, France) IN: Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 285-291. refs

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A new paradigm for studying motion perception is presented. This approach is based on a class of stimuli devised for testing the relative strength of stimulus attributes in eliciting motion perception by correspondence matching. In this class of stimuli, different attributes are matched simultaneously in the spatio-temporal domain in a systematic, algorithmic manner which allows each attribute to produce motion in an arbitrary direction independently of the other attributes. This results in animation sequences in which many different motion paths may coexist, each path due to a different attribute. Such an arrangement allows a direct comparison of the strength of attributes in eliciting movement. Results from psychophysical experiments based on this paradigm can be used to develop complex motion detection models for machine vision systems which attempt to approximate human performance. Similar methods are discussed for studying stereopsis mechanisms. Author

A90-38869

**MOTION PERCEPTION MODEL WITH INTERACTIONS BETWEEN SPATIAL FREQUENCY CHANNELS**

MASAMI OGATA and TAKAO SATO (ATR Auditory and Visual Perception Research Laboratories, Osaka, Japan) IN: Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 292-299. refs  
Copyright

Several recent studies have proposed models of local motion detection for visual perception using spatiotemporal filters. However, these models have limited their motion perception capacity by the use of only one spatial frequency channel. But in the human visual system, it has been shown by various psychophysical studies that there are interactions between spatial frequency channels. In this paper, therefore, a simple approach to introducing channel interactions into local motion detection models is proposed. True velocity is given as the intersection of lines representing the possible solutions on the velocity plane. Scalar motion sensors are used to get each line. Channel interactions are incorporated by plotting lines from multiple spatial frequency channels on the same velocity plane and finding their intersection. The effectiveness of these procedures was demonstrated with moving random dot patterns. Author

A90-38871

**ELEVEN COLORS THAT ARE ALMOST NEVER CONFUSED**

ROBERT M. BOYNTON (California, University, La Jolla) IN: Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 322-332. refs  
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Optimal examples are identified of the 11 basic colors which were easily named and never confused by 20 test subjects. Experimental evidence of nonconfusability is presented. The deliberate use of such examples to segregate information in reflective displays is addressed. C.D.

A90-38872

**UNIFIED MODEL FOR HUMAN COLOR PERCEPTION AND VISUAL ADAPTATION**

S. LEE GUTH (Indiana University, Bloomington) IN: Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 370-390. refs (Contract AF-AFOSR-87-0089)  
Copyright

A model is described that combines features of both classical and recent theories of color vision and visual adaptation. Neural signals from cone receptors activate gain control mechanisms, which cause neural attenuations to become proportionally greater as receptor signals grow. The attenuated signals are fed to three mechanisms of one of two 'opponent colors' systems, and the resulting signals, which are compressed at a final stage, are used to either encode brightness and color appearance or to mediate discriminations and detections of lights. The model provides reasonable accounts of a very diverse body of data. Author

A90-38928

**BIOLOGICAL AND COGNITIVE DETERMINATION OF THE GRAVITATIONAL REFERENCE FRAME**

HEINZ-GUNTHER TITTMAR (Ulster, University, Newtownabbey, Northern Ireland) Acta Astronautica (ISSN 0094-5765), vol. 21, April 1990, p. 267-269. refs  
Copyright

It is argued that space sickness is not so much a physiological problem, but a psychological one, having its roots in the perception of the environment, and its associated cognitive processing. This cognitive processing is argued to be that of field dependence and field independence, for which exist psychobiological and cognitive assessment tests. Since there is an obvious economic advantage

in the use of cognitive testing, it is recommended that this could be used as an initial screening when selecting for astronauts.

Author

A90-39641

**PILOTS' PERCEPTION OF RISKS AND HAZARDS IN GENERAL AVIATION**

DAVID O'HARE (Otago, University, Dunedin, New Zealand) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 61, July 1990, p. 599-603. refs  
Copyright

This paper investigates the pilots' assessment of the risks associated with general aviation (GA). Pilots were asked to fill out the Aeronautical Risk Judgment Questionnaire (ARJQ) to obtain data on their perceptions of their own abilities, the willingness to take risks, the hazard awareness, and the judgment of the risks of GA. They were then subjected to a computerized tests of flight decision-making involving a proposed VFR flight in marginal weather conditions. Data from the ARJQ showed a generally optimistic self-appraisal of abilities and low levels of risk and hazard awareness. Subjects under 30, rated the likelihood of being involved in an accident more highly than the older pilots, but have overestimated their skill and ability more than the older group. Experienced pilots obtained higher scores on a measure of 'personal invulnerability' from factors commonly associated with accidents. I.S.

A90-40264

**CRITICAL COLOR DIFFERENCES DETERMINED WITH A VISUAL SEARCH TASK**

ALLEN L. NAGY and ROBERT R. SANCHEZ (Wright State University, Dayton, OH) Optical Society of America, Journal, A: Optics and Image Science (ISSN 0740-3232), vol. 7, July 1990, p. 1209-1217. refs  
Copyright

Response times were measured for a visual search task in which the observer was required to find a target that differed from distracting stimuli only in color. In the first experiment the search time was measured as a function of display density for both small and large color differences. With small color differences response time increased with display density, indicating a serial search, but with large color differences response time was constant, indicating a parallel search. In the second experiment the color difference required for parallel search was measured in eight different directions from the distracter chromaticity. These color differences were much larger than threshold color differences and were not well represented by the ellipse used to describe the threshold contour around a point in color space. Author

A90-40278

**THE ROLE OF OCULAR MUSCLE PROPRIOCEPTION IN VISUAL LOCALIZATION OF TARGETS**

GABRIEL M. GAUTHIER, DANIELLE NOMMAY, and JEAN-LOUIS VERCHER (Aix-Marseille I, Universite, Marseille, France) Science (ISSN 0036-8075), vol. 249, July 6, 1990, p. 58-61. Research supported by CNRS and Institut National de la Sante et de la Recherche Medicale. refs  
Copyright

The role of ocular muscle proprioception in the localization of visual targets has been investigated in normal humans by deviating one eye to create an experimental strabismus. The passively deviated eye was covered and the other eye viewed the target. With a hand-pointing task, targets were systematically mislocalized in the direction of the deviated nonviewing eye. A 4- to 6-degree error resulted when the nonviewing eye was offset 30 degrees from straight ahead. When the eye was deviated, the perceived 'straight-ahead' was also displaced, by a similar amount, in the same direction. The mislocalization of visual objects is attributed to the change in proprioceptive information issued from the nonviewing, deviate eye. Thus, proprioception contributes to the localization of objects in space. Author

A90-42286

**LIMITS OF FUSION AND DEPTH JUDGMENT IN STEREOSCOPIC COLOR DISPLAYS**

YEI-YU YEH and LOUIS D. SILVERSTEIN (Honeywell Systems and Research Center, Phoenix, AZ) Human Factors (ISSN 0018-7208), vol. 32, Feb. 1990, p. 45-60. refs  
Copyright

The effective use of stereoscopic display systems is dependent, in part, on reliable data describing binocular fusion limits and the accuracy of depth discrimination for such visual display devices. These issues were addressed in three experiments, as were the effects of interocular cross talk. Results showed that limits of fusion were approximately 27.0 min arc for crossed disparity and 24.0 min arc for uncrossed disparity. Subjects were extremely accurate in distinguishing the relative distance among four groups of stimuli, were able to identify a pair of stimuli colocated at the same depth plane within each group, and were fairly accurate in scaling stimuli along the depth dimension. The mean error in using disparity as a depth cue was approximately 2.2 min arc. Interocular cross talk had little effect on fusion limits for 200-ms stimulus presentations but significantly affected fusion for longer (2s) presentations that enabled vergence responses to be executed. Depth discrimination performance was essentially unaffected by interocular cross talk; however, cross talk significantly influenced subjective ratings of image quality and visual comfort. Author

A90-42287

**PROXIMITY COMPATIBILITY AND INFORMATION DISPLAY - EFFECTS OF COLOR, SPACE, AND OBJECTNESS ON INFORMATION INTEGRATION**

CHRISTOPHER D. WICKENS and ANTHONY D. ANDRE (Illinois, University, Savoy) Human Factors (ISSN 0018-7208), vol. 32, Feb. 1990, p. 61-77. refs  
(Contract DAAA15-86-K-0013)  
Copyright

Experiments in which different features of the display of multiple channels of information are varied in their proximity to one another are reported. The display presents three indicators of aircraft stall danger (airspeed, flaps, and bank). In Experiment 1, the spatial proximity between indicators and their distinctiveness in color were manipulated. Spatial proximity had little effect on either focused attention or integration, whereas a distinct color code improved focused attention and disrupted integration. In Experiment 2 the three indicators were presented as a bar graph or were combined as features of an object display, either with or without color coding of the separate dimension. Author

A90-42289

**OPTICAL FACTORS IN JUDGMENTS OF SIZE THROUGH AN APERTURE**

JAMES S. MARSH (West Florida, University, Pensacola, FL) and LEONARD A. TEMME (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) Human Factors (ISSN 0018-7208), vol. 32, Feb. 1990, p. 109-118. refs  
Copyright

An expression is derived relating retinal image size to object size when the object is seen through a pupil forming an aperture stop for the eye. The image size is related to object position, pupil position, and state of accommodation of the eye on the assumption that the chief ray determines the image of an out-of-focus object. Data obtained by Biersdorf and Baird agree with the expression. The expression is used as the basis of a quantitative discussion of Hennessy's informal experiment and Roscoe's zoom lens hypothesis. Author

A90-42455#

**SUPERIMPOSED PERSPECTIVE VISUAL CUES FOR HELICOPTER HOVERING ABOVE A MOVING SHIP DECK**

M. NEGRIN, A. GRUNWALD, and A. ROSEN (Technion - Israel Institute of Technology, Haifa) Associazione Industrie Aerospaziali and Associazione Italiana di Aeronautica ed Astronautica, European Rotorcraft Forum, 14th, Milan, Italy, Sept. 20-23, 1988, Paper. 26 p. refs

The manual low altitude hovering task above a small moving ship-deck is investigated using visual field cues supplemented by superimposed display symbology. The effectiveness of the superimposed visual field information on the hovering performance is studied. This additional information can be realized by inertial visual references generated on the ship deck, and/or by a helicopter-based head-up display. For the ship deck references, inertially stable three-dimensional visual structures such as line drawn cube or box are investigated. For the head-up display information, only the artificial horizon is investigated. The results of the investigation clearly show that the hovering performance is improved by the inclusion of inertially stable visual cues. Moreover, it is shown that the performance is almost independent of the size of the three-dimensional structure. Thus, it is possible to realize the ship-based visual references within practical physical dimensions, i.e. a cube size of 1 meter. Author

N90-23878# Naval Aerospace Medical Research Lab., Pensacola, FL.

**MENTAL LAPSES AND EVENT-RELATED POTENTIALS**

Interim Report, 1988 - 1989

R. R. STANNY Nov. 1989 36 p  
(AD-A219454; NAMRL-1347) Avail: NTIS HC A03/MF A01  
CSCL 05/8

Event-related potentials (ERPs) were recorded from 10 subjects as they performed an acoustic target detection task. Each subject's ERPs were sorted by performance level, on a trial-by-trial basis. A number of ERP measuring procedures then were compared in terms of their abilities to detect episodes of low behavioral performance. The ERP feature that proved most sensitive to fluctuations in performance was P3 (P300) amplitude. Weighted, time-averaged amplitude measures outperformed peak amplitude measures by a substantial margin. The results are discussed as they bear on using ERPs to detect lapses of equipment operator performance. GRA

N90-23879# Naval Submarine Medical Research Lab., Groton, CT.

**EFFECT OF EXTRANEIOUS COLOR-CODED TARGETS ON IDENTIFICATION OF TARGETS ON CRT DISPLAYS Interim Report, Oct. 1988 - Oct. 1989**

SAUL M. LURIA, DAVID F. NERI, MATTHEW J. SHIM, and ROBYN BIVENOUR 16 Jan. 1990 20 p  
(AD-A219473; NSMRL-1154) Avail: NTIS HC A03/MF A01  
CSCL 17/1

Sonar operations, using the broadband waterfall display, search for a thin line which constitutes a target track. Although current displays are monochromatic, color may well be added in the future. To examine the usefulness of color coding the target tracks on such displays, the response times of individuals to lines coded with different colors were measured; different sets of colors were compared; the effect of varying the background colors measured; and brightness; and the effects of different colors of ambient lighting were measured. These studies have shown that operators can handle as many as 20 different colors without undue confusion, that color recognition is best with a background of intermediate gray rather than white or black, that performance is the same with black and blue backgrounds, and that the color of the ambient light does not affect performance with CRT displays. Currently, the basic problem is how many different colors can be used to code different tracks without undue confusion. As noted it was found that a surprisingly large number of colors can be recognized and recalled without undue confusion on the part of the operator. These studies, however, presented only one color-coded target at a time. The present study sought to determine to what extent the CRT operator's performance is affected by the presence on the screen of several target tracks, in different colors. GRA

N90-23880# Naval Postgraduate School, Monterey, CA.

**ANALYSIS OF THE ACCURACY OF A PROPOSED TARGET MOTION ANALYSIS PROCEDURE M.S. Thesis**

BERNABE C. CUBEROS Sep. 1989 66 p  
(AD-A219481) Avail: NTIS HC A04/MF A01 CSCL 17/11

The accuracy is investigated for the recently proposed passive bearings-only Target Motion Analysis (TMA) procedure. The primary method of analysis is to compare computer generated positions of a Target that is moving with a constant course and speed, with the procedurally derived estimated positions. A computer model was developed which simulated several possible interactions between the Target and Own Ship. Estimated parameters of the Target track were computed using the procedure under analysis. These values were compared to the true values generated by the simulation. An analysis of the TMA procedure as originally proposed showed that it failed to accurately estimate the target track parameters. However with some modifications, the accuracy improved significantly and it is felt that the procedure can accurately estimate target range (but not necessarily course and speed) for some target geometries. GRA

**N90-23881#** National Defence Research Establishment, Stockholm (Sweden). Dept. of Human Studies.

**TARGET SELECTION IN ANTI-TANK HELICOPTER OPERATIONS: RELATIVE WEIGHT OF CUES IN TARGET EVALUATION JUDGEMENTS**

ANDERS CARLSTROEM Nov. 1989 20 p  
(FOA-C-50072-5.2; ISSN-0347-7665; ETN-90-96592) Avail: NTIS HC A03/MF A01

Target evaluation judgements in anti-tank helicopter operations were studied using policy capturing. The subjects were Swedish army helicopter pilots with different levels of experience of anti-tank helicopters and a group of helicopter mechanics. The results showed that the cues tactical importance of target and clarity received high weights while the cue distance to target received weight near zero. It is possible that pilots pay only small attention to distance due to confidence in the weapon system as long as it is operated within its normal range. ESA

**N90-23882#** National Defence Research Establishment, Stockholm (Sweden). Dept. of Human Studies.

**TARGET SELECTION IN ANTI-TANK OPERATIONS: EFFECTS OF EXPERIENCE**

ANDERS CARLSTROEM Nov. 1989 21 p  
(FOA-C-50073-5.2; ISSN-0347-7665; ETN-90-96593) Avail: NTIS HC A03/MF A01

Target evaluation judgements in anti-tank helicopter operations were studied using policy capturing with clarity, importance of target, and threat as cues. The subjects were helicopter pilots from U.S. and the Swedish army aviation with different levels of experience. The general finding was an overall similarity in judgements showing clarity to have the highest weight for decision to fire a missile. However, for scout helicopter pilots threat received the highest weight. The divergence could be explained by difference in experience. The results could have application for tactical training. ESA

**N90-23883#** National Defence Research Establishment, Stockholm (Sweden). Dept. of Human Studies.

**MODE OF PRESENTATION OF CUES IN POLICY CAPTURING: A COMPARISON BETWEEN VERBAL AND PICTORIAL PRESENTATION OF TARGETS IN JUDGEMENT OF PROBABILITY TO FIRE**

ANDERS CARLSTROEM Nov. 1989 23 p  
(FOA-C-50074-5.2; ISSN-0347-7665; ETN-90-96594) Avail: NTIS HC A03/MF A01

The effect of differences in modes of cue format on ratings of cues in a target selection task was studied using policy capturing. Two different modes of presentation were used: written description versus photographic slides. The subjects were U.S. and Swedish army aviators. In the written description situation the subjects used two cues and in the pictorial situation only one cue for their judgement. Concerning which cue was most important, the utility/transport helicopter pilots made the same judgement in the two conditions while the attack/anti-tank helicopter pilots made different judgements in the two situations. It is possible that this difference is due to divergences in personal involvement in the

situations presented. The difference in utilization of the cues in the two modes of presentation should be noticed in tactical training. ESA

**N90-23884#** Pennsylvania Univ., Philadelphia.

**NEUROMORPHIC OPTICAL SIGNAL PROCESSING AND IMAGE UNDERSTANDING FOR AUTOMATED TARGET RECOGNITION**

NABIL H. FARHAT Dec. 1989 95 p Sponsored by ONR, Boston, MA  
(AD-A219827; EO/MO-89-1) Avail: NTIS HC A05/MF A01 CSCL 12/9

The goal of research is study of computation and learning in neural net models and demonstration of their utility in image understanding and neuromorphic information processing systems for remote sensing and target identification. The approach to achieving this goal has two facets. One is combining innovative architectures and methodologies with suitable algorithms to exploit existing and emerging photonic technology in the implementation of large-scale neurocomputers for use in: the study of complex self-organizing and learning systems, fast solution of optimization problems, feature extraction, (formation of object representation), and pattern recognition. The second facet of the approach is to demonstrate and assess the capabilities of neuromorphic processing in solution of selected inverse-scattering and recognition problems. The problem studied as a test bed for the work is that of automated radar target recognition because of the existing capabilities and expertise in this area. GRA

**N90-23885#** California Univ., Santa Barbara.

**HAND SHAPING: A PARADIGM FOR COGNITIVE/MOTORIC INTERACTION Final Report, 1 Jul. 1987 - 31 Dec. 1989**

ROBERTA L. KLATZKY and JAMES W. PELLEGRINO 10 Feb. 1990 6 p  
(Contract AF-AFOSR-0230-87; AF PROJ. 2313)  
(AD-A219908; AFOSR-90-0359TR) Avail: NTIS HC A02/MF A01 CSCL 05/8

The research efforts during the contract period resulted in three submitted or published papers and one doctoral dissertation. The papers reported: a series of experiments demonstrating that activation of a hand-shape representation could facilitate subsequent judgements about actions on objects; an investigation of reshaping during responses to objects; and the development of a controlled object-display system to measure response time and movement time. A series of experiments demonstrating that priming of a hand shape was disrupted by simultaneous preparation for a sequence of finger responses but not by preparation for a sequence of spoken syllables were reported. In general, the results suggest a cognitive/motoric representation of the hand with which actions on objects can be internally modeled, and which may serve a preparatory role in performance. GRA

**N90-23886#** Harvard Univ., Cambridge, MA. Dept. of Psychology.

**DURIP: COMPUTATIONAL MODELING OF COGNITIVE PROCESSES Final Report, 1 Dec. 1988 - 30 Nov. 1989**

STEPHEN M. KOSSLYN 6 Mar. 1990 5 p  
(Contract AF-AFOSR-0090-89; AF PROJ. 3842)  
(AD-A219934; AFOSR-90-0361TR) Avail: NTIS HC A01/MF A01 CSCL 05/8

The equipment purchased under this grant consisted of three VAX stations and two Macintosh II systems. The equipment was used by three major investigators and a large number of their graduate students for such purposes as speech analysis and synthesis and stimulus construction, connectionist modeling of visual systems, experimentation and perception, attention and memory, and the effects of representational format on transfer effects in learning. Nearly 20 publications resulted or are in press in addition to several presentations at national and international scientific meetings. GRA

**N90-24719#** Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.

**THE INCREMENTAL VALIDITY OF SPATIAL AND PERCEPTUAL-PSYCHOMOTOR TESTS RELATIVE TO THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY Final Report, Jul. - Nov. 1989**

HENRY H. BUSCIGLIO Feb. 1990 42 p  
(AD-A220903; ARI-TR-883) Avail: NTIS HC A03/MF A01  
CSCS 05/9

This research evaluates the utility of new Army tests of spatial, perceptual, and psychomotor abilities developed under the Army's Project A (Improving the Selection, Classification, and Utilization of Army Enlisted Personnel). Utility is judged in terms of incremental validity over the Armed Services Vocational Aptitude Battery (ASVAB). The analyses are stepwise regressions using predictors and performance tests from the 1985 Concurrent Validation of Project A. A variety of performance measures, ranging from comprehensive to task-level, served as criteria for the analyses. In the analyses, optimal combinations of Project A predictors substantially augmented the proportion of criterion variance explained by optimal combinations of ASVAB scores alone, particularly for such comprehensive measures as General Soldiering Proficiency and the combined score on written tests of school and job knowledge. In certain Military Occupational Specialties (MOS), Project A scores led to increments in the predictability of more specific criteria, such as Target Identification and Navigation. While no strong support was found for the relative superiority of spatial versus perception psychomotor scores, there was evidence that some individual tests (viz., Assembling Objects, Figural Reasoning, and Target Identification) were more useful than others as incremental predictors of the criteria. Because of the concurrent design used and the lack of opportunities for cross-validation, these generally favorable findings only suggest the results to be expected from the Longitudinal Validation of Project A.

GRA

**N90-24720#** Embry-Riddle Aeronautical Univ., Daytona Beach, FL.

**PILOT DECISION-MAKING TRAINING Final Technical Report, Jun. 1985 - Dec. 1988**

THOMAS J. CONNOLLY May 1990 88 p Sponsored by Air Force Human Resources Lab., Williams AFB, AZ  
(AD-A221349; AFHRL-TP-88-67) Avail: NTIS HC A05/MF A01  
CSCS 01/3

The effectiveness of a simulator-based approach to training pilot skills in risk assessment and decision making was evaluated in a sample for pilots enrolled in a university aviation science program. Experimental group subjects received 4 hours of classroom instruction designed to enhance pilot judgement skills, followed by 4 hours of simulated cross-country flights during which several critical in-flight events occurred. Subjects in the control group received classroom instruction in basic instrument flying, followed by simulator sessions emphasizing instrument flight. Measures of pilot judgement were obtained on all subjects before and after the training, and subjects in the experimental judgement-trained group performed significantly better on the post-training simulation than did control group subjects. The findings suggest that significant gains in pilot decision-making skill can be obtained through the use of the judgement training materials along with simulator practice. The implications of these findings for Air Force undergraduate pilot training are discussed. Included as an appendix to this document is a prototype manual for pilot decision making. This manual is designed for use by Air Force student pilots as part of their regular training program. A specific plan for implementation is proposed. At a later date, similar advanced training materials may be developed for both simulator and in-flight use.

GRA

**N90-24721#** National Aerospace Medical Centre, Soesterberg (Netherlands).

**ACTIVITIES REPORT OF THE NATIONAL AEROSPACE MEDICAL CENTER Annual Report, 1988 [STICHTING NATIONAL LUCHT- EN RUIMTEVAARTGENEESKUNDIG CENTRUM, JAARVERSLAG 1988]**

1988 39 p In DUTCH  
(ETN-90-96936) Avail: NTIS HC A03/MF A01

The personnel selection examinations performed in 1988 are tabulated, and the evolution of the examinations since 1952 is given. The psychological test apparatus was extended and modernized in order to meet the strongly increased demand for psychological aptitude tests. The mental stress of civilian helicopter pilots was investigated. The study of the visual behavior of presbyopic pilots and the use of optical aids was continued. Vestibular effects of gravitational loading were examined using a human centrifuge.

ESA

**N90-24982\*#** North Carolina Univ., Chapel Hill. Dept. of Physical Education, Exercise and Sport Sciences.

**OVERTRAINING AND EXERCISE MOTIVATION: A RESEARCH PROSPECTUS Final Report**

ANTHONY C. HACKNEY In Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 1 16 p Dec. 1989

Avail: NTIS HC A09/MF A02 CSCS 05/9

The problems of exercise overtraining has recently become one of great interest to professionals in the field of human performance assessment. Quite obviously, the ultimate goal of the training process is to improve physical performance. However, excessive training can result in the opposite effect, that is, a performance decline and an impairment in the functional work capacity of the body. Research indicates that both psychological as well as physiological disturbances are quite common in overtrained individuals. For example, psychological changes include increased levels of depression, fatigue, and a lack of motivation. Similarly, impairment of the physiological function of the cardiovascular, metabolic, and endocrine systems also have been found. Some similarities may be found in the psychological and physiological states of crew members exposed to extended space flight and overtrained individuals. Therefore, the possibility exists that the crew members subjected to extended missions in space may develop overstressed or overtrained or both states during their flights. If such states do develop within the crew members, mission performance may be impaired. With these points as a background, the intent is to address potential research directions that NASA may consider viable and of a mutual interest to the researcher. A clear framework by which to begin discussion of research topics is needed; therefore, working definitions of overtraining and exercise motivation are presented. Subsequently, a proposed conceptual model of how exercise overtraining and motivation interact is presented. In support of the proposed model is a brief literature review of relevant areas. Potential research projects are presented and discussed.

Author

**N90-25041\*#** Stonehill Coll., North Easton, MA. Dept. of Mathematics and Computer Science.

**FROM WHERE THEY LOOK TO WHAT THEY THINK: DETERMINING CONTROLLER COGNITIVE STRATEGIES FROM OCULOMETER SCANNING DATA**

STEVEN CUSHING In Old Dominion Univ., NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program 1989 p 60-66 Sep. 1989  
Avail: NTIS HC A09/MF A02 CSCS 05/9

The behavior and cognition of air traffic controllers from oculometer scanning data already obtained for another purpose was studied. There was very little work done to develop models of air traffic controllers, much of what was done was done at Langley. One aim of developing such models is to use them as the basis of decision-support or expert-system tools to assist controllers in their tasks. Such tools are more likely to be effective if they incorporate the strategies that controllers actually use, rather



than steering them in what might be felt to be unnatural directions. Author

**N90-25059\*# Hampton Univ., VA. Dept. of Management.  
A SYSTEMATIC APPROACH TO TRAINING: A TRAINING  
NEEDS ASSESSMENT**

MARGARET H. MANNING In Old Dominion Univ.,  
NASA/American Society for Engineering Education (ASEE)  
Summer Faculty Fellowship Program 1989 p 114-116 Sep.  
1989

Avail: NTIS HC A09/MF A02 CSCL 05/9

In an effort to determine the gap between the actual performance and the necessary performance of employees for the effective and efficient accomplishment of an organization's mission and goals, an organization-wide Training Needs Assessment must be conducted. The purpose of this work was to conduct a training needs analysis and prepare a NASA Langley Catalog of On-Site Training programs. The work included developing a Training Needs Assessment Survey, implementing the survey, analyzing and researching the training needs, identifying the courses to meet the needs, and preparing and designing an On-Site Training Catalog. This needs analysis attempted to identify performance weaknesses and deficits; seek out and provide opportunities for improved performance; anticipate and avoid future problems; enhance and create new strengths. The end product is a user-friendly catalog of on-site training available. The results include: top-down approach to needs assessment; improved communication with training coordinators; 98 percent return rate of the Training Needs Assessment survey; complete, newly designed, user-friendly catalog; 167 catalog descriptions advertised; 82 new courses advertised; training logo; and request for the training application form. Author

## 54

## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**A90-38852**

**STEREO TV IMPROVES MANIPULATOR PERFORMANCE**

ROBERT E. COLE and DONNA L. PARKER (Hawaii, University, Honolulu) IN: Three-dimensional visualization and display technologies; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 18-27. Research sponsored by Martin Marietta Corp. refs  
Copyright

Six observers, experienced in telerobotic operations, were used across four replicated studies of remote performance of a simulated Space Station assembly task. An alignment/insertion task was performed with a remotely operated manipulator arm viewed either directly or through stereoscopic or monoscopic TV viewing systems. Target position, space light, and learning effects were also assessed by measures of task time and manipulator collisions. Results clearly show the superiority of stereo TV over mono viewing systems. They suggest that learning can also improve performance under mono view when accompanied by direct view and stereo view experience, but such learning is specific to the perceptual and motor conditions that were present in practice. Author

**A90-38853**

**LOW COST DESIGN ALTERNATIVES FOR HEAD MOUNTED  
STEREOSCOPIC DISPLAYS**

STEPHEN W. MARTIN (U.S. Navy, Naval Ocean Systems Center, San Diego, CA) and RICHARD C. HUTCHINSON (San Diego State University Foundation, CA) IN: Three-dimensional visualization and display technologies; Proceedings of the Meeting, Los Angeles,

CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 53-58. refs  
Copyright

Described is a low cost design approach for stereoscopic head mounted displays. The approach is to couple two miniature image sources to a helmet using an aviator's night vision system mount, and directly view the images using telescope eyepieces. Two different types of displays constructed for teleoperation applications are described. These displays employ miniature CRTs with RS-170A compatible video driver electronics, 24.5-mm focal length eyepieces, weigh approximately six pounds, provide apparent horizontal FOVs of 40 and 55 degrees, and achieve from 250 to 500+ TV lines per picture height of horizontal resolution. Author

**A90-38859\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**VISIONS OF VISUALIZATION AIDS - DESIGN PHILOSOPHY  
AND OBSERVATIONS**

STEPHEN R. ELLIS (NASA, Ames Research Center, Moffett Field, CA; California, University, Berkeley) IN: Three-dimensional visualization and display technologies; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 220-227. refs  
Copyright

Aids for the visualization of high-dimensional scientific or other data must be designed. Simply casting multidimensional data into a two-dimensional or three-dimensional spatial metaphor does not guarantee that the presentation will provide insight or a parsimonious description of phenomena implicit in the data. Useful visualization, in contrast to glitzy, high-tech, computer-graphics imagery, is generally based on preexisting theoretical beliefs concerning the underlying phenomena. These beliefs guide selection and formatting of the plotted variables. Visualization tools are useful for understanding naturally three-dimensional data bases such as those used by pilots or astronauts. Two examples of such aids for spatial maneuvering illustrate that informative geometric distortion may be introduced to assist visualization and that visualization of complex dynamics alone may not be adequate to provide the necessary insight into the underlying processes. Author

**A90-38860\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**SCIENTIFIC WORK ENVIRONMENTS IN THE NEXT DECADE**

JULIAN E. GOMEZ (NASA, Ames Research Center, Moffett Field, CA) IN: Three-dimensional visualization and display technologies; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 234-239. refs  
Copyright

The applications of contemporary computer graphics to scientific visualization is described, with emphasis on the nonintuitive problems. A radically different approach is proposed which centers on the idea of the scientist being in the simulation display space rather than observing it on a screen. Interaction is performed with nonstandard input devices to preserve the feeling of being immersed in the three-dimensional display space. Construction of such a system could begin now with currently available technology. Author

**A90-38870\*** New York Inst. of Tech., Dania, FL.

**APPLICATION OF VISUAL PSYCHOPHYSICS TO THE DESIGN  
OF VIDEO SYSTEMS FOR USE IN SPACE**

WILLIAM E. GLENN and KAREN G. GLENN (New York Institute of Technology, Dania, FL) IN: Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 308-320. refs  
(Contract NASW-4242)  
Copyright

A series of two-alternative forced choice experiments was conducted to compare the sharpness of televised moving images sampled using cardinal or diagonal patterns with reference images

of varying resolution. The results indicate that both image sampling and resolution orientation play an important role in determining apparent sharpness of the images. If an image has better cardinal than diagonal resolution, the apparent sharpness is significantly greater. Thus, if the polar distribution of resolution is limited by the sampling process, diagonal sampling can be expected to yield a sharper image than cardinal sampling with the same number of pixels. C.D.

**A90-40161#**

### **EFFECTS OF BIODYNAMIC COUPLING ON THE HUMAN OPERATOR MODEL**

S. J. MERHAV (Technion - Israel Institute of Technology, Haifa) and M. IDAN Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 13, July-Aug. 1990, p. 630-637. Previously cited in issue 23, p. 3693, Accession no. A89-52610. refs Copyright

**A90-40380**

### **HUMAN FACTORS AND SAFETY CONSIDERATIONS OF NIGHT VISION SYSTEMS FLIGHT**

ROBERT W. VERONA (U.S. Army, Center for Night Vision and Electro-Optics, Fort Belvoir, VA) and CLARENCE E. RASH (U.S. Army, Aeromedical Research Laboratory, Fort Rucker, AL) IN: Display system optics II; Proceedings of the Meeting, Orlando, FL, Mar. 30, 31, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 2-12. refs Copyright

Issues related to military aviation helmet mounted night vision devices based on image intensifier technologies are examined. The characteristics of the U.S. Army's night vision goggles and aviation night vision imaging system are described. Consideration is given to impact of head supported weight, the effects of a shift in the center-of-gravity, visual acuity, internal and external light sources, and the problem of biocular vs. binocular presentation. Also, failure modes, the field-of-view, visual fields, sensor parameters, and environmental considerations are discussed. R.B.

**A90-40384**

### **HELMET MOUNTED DISPLAYS - EVALUATION OF IMPACT ON THE OPERATOR**

JOHN A. STERN, ROBERT GOLDSTEIN, and DOUGLAS N. DUNHAM (Washington University, Saint Louis, MO) IN: Display system optics II; Proceedings of the Meeting, Orlando, FL, Mar. 30, 31, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 42-51. refs (Contract F33615-85-C-0514) Copyright

To test the impact of a helmet mounted display on the operator, steady state evoked responses to the rapidly flickering display were collected from pilots flying refuel and ingress missions. Also, the aspects of the visual search were recorded using electrooculographic procedures. It is found that use of the helmet mounted device reduce horizontal and vertical visual search activity under all conditions except threat avoidance and post-threat recovery. The results suggest that pilots can rapidly learn to make effective use of the helmet mounted display information and that the use of the displays makes it possible to spend less time looking at instrument panels. R.B.

**A90-40389**

### **DESIGNING THE VIRTUAL COCKPIT MAN-MACHINE INTERFACE**

CHRIS P. GIBSON (Royal Aerospace Establishment, Farnborough, England) and WAYNE L. MARTIN (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: Display system optics II; Proceedings of the Meeting, Orlando, FL, Mar. 30, 31, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 85-93. Research supported by the Ministry of Defence Procurement Executive. Copyright

A Visually-Coupled Airborne Systems Simulator and a panoramic

helmet mounted display are used to study the relative efficiency of several man-machine interface configurations and the effect of pilot strategy in conducting a realistic interdiction-type mission. The results of the simulation tests are presented and evaluated, focusing on the acceptability of the man-machine interface configurations to the users. Also the applications of the interface configurations and the impact of the results for the development of the virtual cockpit are discussed. R.B.

**A90-40390**

### **EYE CENTERED INTERFEROMETRIC LASER PROTECTION**

JON D. MASSO (American Optical Corp., Southbridge, MA) IN: Display system optics II; Proceedings of the Meeting, Orlando, FL, Mar. 30, 31, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 96-102. Research supported by the U.S. Army and U.S. Navy. Copyright

Selective reflection by interference provides laser protection but is angular sensitive and thus the retinal coverage is inherently limited. It can be shown that thin film stacks are similar in function to holograms and rugates. Eye protection requires optimization of angular coverage and spectral bandwidths. These are intimately related and are a function of the available modulation of the indices of refraction. Maximum protection is obtained by designing the filter such that those rays directed toward the center of rotation of the eye are blocked. Practical flight goggles are being manufacture based on these principles. Author

**A90-40391**

### **A NEW APPROACH TO LASER FILTERS**

JOHN A. BROWN (John Brown Associates, Inc., Berkeley Heights, NJ) and WILLIAM A. THORNTON (Prime-Color, Inc., Cranford, NJ) IN: Display system optics II; Proceedings of the Meeting, Orlando, FL, Mar. 30, 31, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 103-111. refs (Contract DAMD17-88-C-8194; DAAA21-89-M-0554) Copyright

Approaches to protecting the eyes of military personnel from laser beams are examined, including notch filters such as holographic interference filters and absorptive dye filters. An alternative to notch filters is proposed based on an interference filter that blocks all of the visual spectrum except for three narrow transition bands in blue, green, and red. This type of filter transmits only about 6 percent of the incident light, while providing bright and clear color vision. R.B.

**A90-40839**

### **ON-LINE ESTIMATION OF HUMAN OPERATOR WORKLOAD**

W. D. RENCKEN and H. DURRANT-WHYTE (Oxford, University, England) IN: IEEE Conference on Decision and Control, 28th, Tampa, FL, Dec. 13-15, 1989, Proceedings. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1989, p. 785, 786. refs Copyright

An algorithm that is able to estimate adaptively the performance of a human operator in a series of overlapping tasks is presented. The algorithm has its foundations in the multiple-resource-pool (MRP) model of human operator workload. Each task performed by the operator is split into a number of subtasks, with each subtask in turn modeled by a finite-impulse-response (FIR) filter channel. As each subtask is executed, the channel bandwidths are updated to provide the weights of the FIR filter and estimates of the correlation between the different channels. The correlation gives an indication of the ability to perform tasks simultaneously. The algorithm was tested in a real-time operator framework in which the operator had to perform different simple tasks simultaneously. I.E.

**A90-41116#**

### **LIFE SUPPORT SYSTEM - DORNIERS CONTRIBUTION FOR SPACE APPLICATIONS**

KARL-OTTO HIENERWADEL, HELMUT PREISS, and GERVINO

WALTER Dornier Post (ISSN 0012-5563), no. 2, 1990, p. 61-63.  
Copyright

An environmental control and life support system (ECLSS) with varied mission requirements in mind is being designed with a range of areas in consideration. This wide range of requirements includes atmospheric control, spacesuits, water supply and disposal of both water and waste, food supply and medical care. The autonomous extravehicular life support module (European spacesuit) is designed for six hours of extravehicular activity with an additional one hour reserve time. Further, the provision of a network of regenerative systems will be a significant contribution towards solving problems of logistics in future long-term missions. R.E.P.

**A90-41198\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**A PROTOTYPE AUTONOMOUS AGENT FOR CREW AND EQUIPMENT RETRIEVAL IN SPACE**

J. D. ERICKSON (NASA, Johnson Space Center, Houston, TX), D. E. PHINNEY, R. S. NORSWORTHY, M. ZACKSENHOUSE, K. T. HARTNESS (Lockheed Engineering and Sciences Co., Houston, TX) et al. IN: IEA/AIE-89; Proceedings of the Second International Conference on Industrial and Engineering Applications of Artificial Intelligence and Expert Systems, Tullahoma, TN, June 6-9, 1989. Volume 2. Tullahoma, TN, University of Tennessee, 1989, p. 1052-1058. refs

Copyright

The ground-based demonstration of Extra Vehicular Activity (EVA) Retriever, a voice-supervised, intelligent, free-flying robot, is designed to evaluate the capability to retrieve objects (astronauts, equipment, and tools) which have accidentally separated from the Space Station. The EVA Retriever software is required to autonomously plan and execute a target rendezvous, grapple, and return to base while avoiding stationary and moving obstacles. The software architecture incorporates a hierarchical decomposition of the control system that is horizontally partitioned into five major functional subsystems: perception, world model, reasoning, sensing, and acting. The design provides for supervised autonomy as the primary mode of operation with teleoperation as the backup mode. It is intended to be an evolutionary system improving in capability over time and as it earns crew trust through reliable operation. Author

**N90-23887\*** Behavioral Health Systems, Inc., Ossining, NY.

**VOICE MEASURES OF WORKLOAD IN THE ADVANCED FLIGHT DECK: ADDITIONAL STUDIES Final Report**

SID J. SCHNEIDER and MURRAY ALPERT Washington  
NASA Nov. 1989 38 p  
(Contract NAS1-18278)  
(NASA-CR-4258; NAS 1.26:4258) Avail: NTIS HC A03/MF A01  
CSCL 05/8

These studies investigated acoustical analysis of the voice as a measure of workload in individual operators. In the first study, voice samples were recorded from a single operator during high, medium, and low workload conditions. Mean amplitude, frequency, syllable duration, and emphasis all tended to increase as workload increased. In the second study, NASA test pilots performed a laboratory task, and used a flight simulator under differing work conditions. For two of the pilots, high workload in the simulator brought about greater amplitude, peak duration, and stress. In both the laboratory and simulator tasks, high workload tended to be associated with more statistically significant drop-offs in the acoustical measures than were lower workload levels. There was a great deal of intra-subject variability in the acoustical measures. The results suggested that in individual operators, increased workload might be revealed by high initial amplitude and frequency, followed by rapid drop-offs over time. Author

**N90-23888#** Naval Aerospace Medical Research Lab., Pensacola, FL.

**EFFECT OF LASER GLARE AND AIRCRAFT WINDSCREEN ON VISUAL SEARCH PERFORMANCE UNDER LOW AMBIENT LIGHTING Interim Report, 1 Oct. 1987 - 1 Oct. 1988**

JOHN A. DANDREA and JAMES C. KNEPTON 20 Nov. 1989

23 p

(AD-A219456; NAMRL-1350) Avail: NTIS HC A03/MF A01  
CSCL 06/10

Laser illumination of an aircraft may produce intense glare and degrade visually guided human performance. It is possible that disruption of aircrew performance will occur even at laser glare intensities well below the levels that produce eye damage. However, the degree of disruption of visual performance is probably influenced by a variety of factors, including windscreen characteristics and ambient illumination. To determine the interaction of an aircraft windscreen and low-level laser illumination on visual search performance, human subjects were exposed to three laser power densities while seated in a passive cockpit simulator. The subjects performed a visual search by scanning 120 randomly placed disks projected on a screen. The task consisted of detecting and reporting the location of a single smaller target disk randomly placed among the background disks. On different test sessions subjects, under low ambient lighting (1 to 3 cd/m<sup>2</sup>), either viewed the task through an aircraft windscreen or with the windscreen removed. Laser light (514 nm) was projected toward the subject from the center of the disk array on the projection screen using a fiber-optic light guide. Visual search time to locate target disks viewed through the windscreen was significantly longer compared to no windscreen and depended on the intensity of the laser produced glare. GRA

**N90-23889#** Naval Air Development Center, Warminster, PA. Dept. of Air Vehicle and Crew Systems Technology.

**DAZZLING GLARE: PROTECTION CRITERIA VERSUS VISUAL PERFORMANCE Interim Report, Sep. 1985 - Aug. 1990**

JAMES B. SHEEHY 7 Jun. 1989 22 p Sponsored by Naval Air Systems Command, Washington, DC  
(AD-A219676; NADC-89076-60) Avail: NTIS HC A03/MF A01  
CSCL 06/4

Laser eye protection was first introduced into the U.S. Fleet when the need arose to protect aviators and aircrew from neodymium systems. This protection was designed to reduce the incidence energy below the maximum permissible exposure level established by the American National Standards Institute. Since range finders used an infrared wavelength, as defined and therefore not visible to the eye, there was no possibility of glare. With time more systems were developed employing lasers in both the visible and infrared portion of the spectrum. When the lasing of the police helicopter in Los Angeles was first reported in 1981 it immediately became apparent that for wavelengths in the visible portion of the spectrum substantial losses in visual performance could be encountered at safe exposure levels. The incident emphasized the need to develop laser eye protection based on criteria that encompassed both transient (glare) and permanent (burns, hemorrhagic lesions) effects. The goal of this research project was to establish protection levels based on performance rather than damage criteria. GRA

**N90-23890#** Illinois Univ., Champaign. Dept. of Psychology.

**ADDING A DIMENSION: TIME AS A FACTOR IN THE GENERALIZABILITY OF PREDICTIVE RELATIONSHIPS Interim Report**

CHARLES L. HULIN, REBECCA A. HENRY, and SHARON L. NOON Jan. 1990 37 p Submitted for publication  
(Contract F33615-87-C-0014)  
(AD-A219679; AFHRL-TP-89-67) Avail: NTIS HC A03/MF A01  
CSCL 05/8

An analysis of trends in predictive validity coefficients across time and repeated performance assessments shows highly significant and consistent trends in validities as a function of time and/or interpolated practice. Commonly used ability measures show decreasing predictive validities for the prediction of temporally more remote performance assessments. Within study corrections for differential restrictions of range and attenuation due to unreliability across the different performance assessments increased the negative slopes of the regressions of predictive validity on time or ordinal position of performance assessment. The median validity decrement from initial to final performance assessment, corrected

for differential range restriction, attenuation, and within study sampling fluctuations was -.29. The mean of the trimmed distribution of corrected validity decrements, after eliminating the two most extreme cases, was -.45. The average within study correlation between predictive validity and time or ordinal position of performance assessment was 0.80. A similar analysis of stability coefficients of time period-by-time period or trial-by-trial performance assessment correlations revealed very similar albeit slightly more consistent findings. Theoretical explanations stressing the dynamic nature of human abilities, the changing nature of abilities required for task performance, and social competition factors are discussed as reasons for the predictive validity decrements. GRA

**N90-23891#** Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

**THE APPLICATION OF KRIGING IN THE STATISTICAL ANALYSIS OF ANTHROPOMETRIC DATA, VOLUME 1 M.S. Thesis**

MICHAEL GRANT Mar. 1990 77 p Sponsored by Aerospace Medical Research Labs., Wright-Patterson AFB, OH (AD-A220613; AFIT/GOR/ENY/ENS/90M-8-VOL-1) Avail: NTIS HC A05/MF A01 CSCL 23/2

Quality flight equipment is essential to flight crew safety and performance. Oxygen masks, night-vision goggles, and other apparatus must fit crew members comfortably and with complete functional precision. A problem currently facing the Air Force is the inconsistent quality of flight equipment. As new equipment is developed to improve crew members' performance, the requirement for design engineers to accurately account for the shape and variability of facial features becomes more critical. The application of kriging in the statistical analysis of anthropometric data is developed to support improvements in the design of flight equipment. Specifically, the geostatistical estimation technique of kriging is used to estimate the facial surfaces which influence the designs of flight apparatus. These surfaces account for the shape of the facial features and minimize the variance between individuals. A Kalman filter is developed to update and aggregate the kriged surfaces. As a proof of concept study, the techniques are demonstrated using data to support the design of the night-vision goggles currently under development. To further enhance the surface estimates, a multivariate analysis is performed to identify the factors which account for the majority of the variability between faces and to group the faces into homogenous clusters. GRA

**N90-23892#** Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

**THE APPLICATION OF KRIGING IN THE STATISTICAL ANALYSIS OF ANTHROPOMETRIC DATA, VOLUME 2 M.S. Thesis**

MICHAEL GRANT Mar. 1990 256 p Sponsored by Aerospace Medical Research Labs., Wright-Patterson AFB, OH (AD-A220614; AFIT/GOR/ENY/ENS/90M-8-VOL-2) Avail: NTIS HC A12/MF A02 CSCL 23/2

The application of kriging in the statistical analysis of anthropometric data to support improvements in the design of flight equipment was developed. Specifically, the geostatistical estimation technique of kriging is used to estimate the facial surfaces which influence the designs of flight apparatus. This appendix provides a graphical representation of the facial data used. The first 25 subjects were included in the trend analysis and the final variogram analysis. The next five subjects were used in the kriging and updating analysis. Following these subjects are a group of five faces which were used only in the trend analysis. The last two faces were considered for the analysis but discarded because of short falls in the data. GRA

**N90-23893#** Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

**THE APPLICATION OF KRIGING IN THE STATISTICAL ANALYSIS OF ANTHROPOMETRIC DATA, VOLUME 3 M.S. Thesis**

MICHAEL GRANT Mar. 1990 110 p Sponsored by Aerospace

Medical Research Labs., Wright-Patterson AFB, OH (AD-A220615; AFIT/GOR/ENY/ENS/90M-8-VOL-3) Avail: NTIS HC A06/MF A01 CSCL 23/2

The application of kriging in the statistical analysis of anthropometric data to support improvements in the design of flight equipment was developed. Specifically, the geostatistical estimation technique of kriging is used to estimate the facial surfaces which influence the designs of flight apparatus. A Kalman filter is developed to update and aggregate the kriged surfaces. As a proof of concept study, the techniques are demonstrated using data to support the design of the night-vision goggles currently under development. The program contained in this appendix was used for labeling the coordinates of the aligned data points. The alignment program is not included. GRA

**N90-23894#** Pennsylvania State Univ., University Park. Dept. of Civil Engineering.

**A COMPARATIVE ANALYSIS OF WORK-HOUR FORECASTING TECHNIQUES AT THE CREW LEVEL M.S. Thesis**

JAMES M. PACE Dec. 1989 118 p

(Contract N00228-85-G-3278)

(AD-A220706) Avail: NTIS HC A06/MF A01 CSCL 05/9

Several different methods can be used to forecast the productivity of labor-intensive construction activities. The results from three widely used method, percent complete, learning curve and standard productivity curve were used to test the practicality of a new forecasting method, the Factor Model, for a single masonry project. Forecasts were made at weekly intervals and then compared with the actual productivity at project completion. All of the methods produced divergent forecasts throughout the first third of the activity. However, the factor model produced a forecast within 4 percent of the final productivity after only 3 percent of the work had been completed. While this research did not show that the factor model produced more accurate forecasts than the other methods, it did show that the forecasts were equally accurate. Thus, it appears that the factor model is a plausible alternative to conventional forecasting techniques. GRA

**N90-23895#** Federal Aviation Administration, Oklahoma City, OK. Civil Aeromedical Administration.

**EFFECTS OF MONITORING UNDER HIGH AND LOW TASKLOAD ON DETECTION OF FLASHING AND COLORED RADAR TARGETS Final Report**

RICHARD I. THACKRAY and R. MARK TOUCHSTONE Jan. 1990 17 p Sponsored by FAA, Washington, DC

(AD-A220313; DOT/FAA/AM-90/3) Avail: NTIS HC A03/MF A01 CSCL 17/9

While midair collisions between aircraft are extremely rare occurrences, near midair incidents are more common. The present study sought to evaluate the gains in conspicuity that might be realized if flashing or color were added as redundant cues to indicate the presence of unexpected, nontracked aircraft entering controlled airspace and to examine the extent to which increased taskload and fatigue might influence the expected gains. Sixty-four subjects monitored a simulated air traffic control task over a 2-hour period for possible conflict situations (their primary task) under either high or low primary taskload conditions. They also monitored for occasional intrusions by light aircraft identifiable on the basis of target shape alone or with color and/or flashing added as redundant cues. Flashing as a redundant cue was found to be superior to color in all aspects tested; unlike color, detection of flashing targets was unaffected by screen location and by changes in primary taskload. Flashing was also least affected by monitoring fatigue. It was concluded that the superiority of flashing over color in attracting attention to objects in a display must be weighed against its possible potential for distraction. A practical means of accomplishing this in operational situations is through the use of touch sensitive displays to both acknowledge/confirm target location and to deactivate flashing. GRA

**N90-23896#** Technische Univ., Berlin (Germany, F.R.). Inst. fuer Luft- und Raumfahrt.

**LUNAR SHELTER**

ANDREAS KUECHLER and ROLAND GLASMACHERS 1989  
53 p In GERMAN  
(ILR-MITT-233(1989); ETN-90-96484) Avail: NTIS HC A04/MF  
A01

A lunar shelter for a future Moon base in the year 2005 is described. It allows the survival of six persons for a minimum of 18 days. The characteristic values of the lunar shelter (length 9.6 m, diameter 4.2 m, mass 20 tons) were evaluated by the transport systems Space Shuttle 2, Advanced Launch System and LTV (Lunar Transportation Vehicle). All vital systems must be manually adjustable in case of computer breakdown. The lunar shelter must be designed for a lifetime of 10 years. The LTV places the lunar shelter on its longitudinal axis parallel to the Moon equator. The nuclear energy supply must be taken into consideration to minimize the radioactive charge of the astronauts. A fiberglass covering is used to protect the structure from the atmospheric stresses. Tables and diagrams show the predicted costs and the possibilities of their reduction. ESA

**N90-24296#** Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).

**THE EUROPEAN EVA SUIT: AN OPTIMIZED TOOL FOR HERMES/MTFF IN-ORBIT OPERATIONS**

L. SIOMIONESCO, J. R. CHEVALLIER, A. I. SKOOG, and N. HERBER (Dornier System G.m.b.H., Friedrichshafen, Germany, F.R.) In ESA, Second European In-Orbit Operations Technology Symposium p 93-98 Dec. 1989

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An historical review of the different concepts of EVA suits, both in U.S. and USSR; is given and the coherence of today's concepts in both countries is shown. The complexity of the U.S. Orbiter, and the type of missions for which it is designed lead to a ground serviced EVA suit system optimized for in-orbit autonomy and mobility. The MIR Salyut and EVA suits are fundamentally housekeeping tools for these stations. They are optimized for on-orbit adjustment and maintenance. An analysis of the technical requirements of crew protection, mobility, life support and crew productivity depending on the type of activities to be performed in-orbit is given. It shows different concepts and associated constraints. Technology developments which are required to make the European EVA space suit system a productivity optimized tool, are discussed. ESA

**N90-24297#** Aeritalia S.p.A., Turin (Italy). Space Systems Group.

**PERSPECTIVE FEATURES OF INTERNAL AUTOMATION AND ROBOTICS FOR SUPPORTING COLUMBUS ATTACHED LABORATORY PAYLOAD OPERATIONS**

MARIO CARDANO, MARIA STELLA LAVITOLA, IGNAZIO BARRACO, and MARC TOUSSAINT (European Space Agency, Paris, France) In ESA, Second European In-Orbit Operations Technology Symposium p 99-112 Dec. 1989

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A payload operations simulation exercise was carried out in the frame of the ESA rider study on Robotics Spacecraft Servicing and Assembly (ROSSA), aimed at analyzing the perspective scenarios and relevance for internal automation and robotics support to the Columbus Attached Laboratory payload mission. Detailed flight operations sequences were generated and analyzed for a set of pressurized payload elements. The preliminary results show that many opportunities for supporting crew activities with internal automation and robotics exist, but internal automation and robotics for some tasks may not be trivial. Additional requirement reviews and preparation activities will lead to the identification of promising concepts to be further investigated in the frame of automation and robotics ground testbed activities. ESA

**N90-24298#** McDonnell-Douglas Space Systems Co., Huntington Beach, CA. Space Station Div.

**TELEROBOTIC APPLICATION TO EVA**

DAVIS E. ANDERSON In ESA, Second European In-Orbit

Operations Technology Symposium p 115-121 Dec. 1989  
Copyright Avail: NTIS HC A19/MF A03; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

An investigation of EVA/teletrobotic cooperation dynamics through development of a data base that incorporates neutral buoyancy testing, verification, and demonstration is presented. A division between human and teletrobotic Extravehicular Activity (EVA) tasks is defined. A propellant tank farm neutral buoyancy experiment is discussed as a combination of teletrobot preferred, human preferred, and interchangeable elements. The capabilities of humans and teletrobots to interact during such EVA operations are applied to the EVA requirements for the operation to determine the best mix of man and machine. The resulting cooperative scenarios are verified by neutral buoyancy simulation. ESA

**N90-24299#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

**HERA AND EVA CO-OPERATION SCENARIOS**

F. DIDOT and W. LUETTGEN In its Second European In-Orbit Operations Technology Symposium p 123-128 Dec. 1989

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Co-operation of EVA astronauts and the Hermes Robot Arm (HERA) for in-orbit servicing operations is addressed. The Columbus Free Flying Laboratory (Free Flyer) has a system life of thirty years. In order to fulfil this specification, concept of a serviceable Resource Module (RM) was issued. Every six months, the Hermes spacecraft will perform servicing tasks on the Free Flyer. The external servicing tasks consist mainly of spacecraft inspection and Orbital Replaceable Unit (ORU) exchange. These servicing tasks can be done either by EVA servicing, or by HERA. Some strategies for EVA mission preparation and scenarios for EVA-HERA combined servicing mission are proposed. The benefit the servicing mission will gain in EVA-HERA co-operations is stated. ESA

**N90-24300#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

**ROBOT-BASED EQUIPMENT MANIPULATION AND TRANSPORTATION FOR THE COLUMBUS FREE FLYING LABORATORY**

W. DEPEUTER, P. PUTZ, and G. COLOMBINA (Tecnospazio S.p.A., Milan, Italy) In its Second European In-Orbit Operations Technology Symposium p 129-134 Dec. 1989

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The concept for a robot-based Equipment Manipulation and Transportation System (EMATS) for the Columbus Free Flying Laboratory is described. EMATS could not only automatically provide the greater part of the payload facility handling and logistics functions during the unmanned microgravity periods, but also perform unmanned servicing operations in conjunction with various logistics vehicles concepts and assist the crew during manned servicing from the Space Station Freedom and from Hermes. To that end, a variety of teletrobotics features are foreseen such as teleoperation and supervised automatic operation from ground or from a small control station aboard the Free Flyer, Hermes, or the Space Station Freedom. The overall EMATS architecture is summarized and the flexibility of the concept is illustrated by results from computer graphics simulations. ESA

**N90-24301#** MATRA Espace, Paris-Velizy (France).

**THE HERMES ROBOT ARM TELEOPERATION AND CONTROL CONCEPT**

G. ANDRE and P. SCHOONEJANS (Fokker B.V., Amsterdam, Netherlands) In ESA, Second European In-Orbit Operations Technology Symposium p 137-149 Dec. 1989 Sponsored in part by Fokker B.V., Amsterdam, Netherlands and ESA

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The teleoperation and control concepts for the Hermes Robot



Arm (HERA) currently under development are presented. Emphasis is placed on the conceptual design of the control architecture and the experimental simulation for evaluation of man machine interfaces for a remotely controlled manipulator on-board a manned spacecraft. Interest and limitations induced by trends in fusion of teleoperation requirements with cockpit automation organization are identified. ESA

**N90-24302#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

### **TELEROBOTIC ARCHITECTURE FOR AN ON-ORBIT SERVICER**

NEVILLE I. MARZWELL /in ESA, Second European In-Orbit Operations Technology Symposium p 151-157 Dec. 1989  
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An on-orbit servicer system has unique functional and human factors requirements. The servicing, whether it be teleoperation task, a supervised control task or an autonomous robotic task, the man-machine interface function is likely to be a bottleneck to the operation of the whole system. The man-machine interface system for a space servicer, namely the operator control station, includes several subsystems with a hierarchical architecture. Those subsystems include a reasoning and planning subsystem (also known as the artificial intelligence planner), a run-time control subsystem, a manipulator control and mechanization subsystem, and a sensing and perception subsystem. Indicative of these potentials, certain generic tasks, suggestive of space assembly, maintenance and repair, were performed in a testbed environment. Through performance in several modes: direct teleoperation, shared control, traded control, and robotic operation, the benefits of the individual technology contributions to the operation were quantized and recommendations for use in telerobotic systems were established. ESA

**N90-24303#** Centre National d'Etudes Spatiales, Toulouse (France).

### **HERA TELEOPERATION TEST FACILITY**

V. BOURDON-HENRY /in ESA, Second European In-Orbit Operations Technology Symposium p 161-165 Dec. 1989  
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The activities of the French Space Agency robotics laboratory are strongly related to the Hermes Robot Arm (HERA) project. With the purpose of providing the HERA team with an experimental support, a testbed was built to simulate some specific HERA tasks such as satellite grasping and berthing of Hermes with the Man Tended Free Flyer (MTFF) of Columbus. This set-up gives the possibility to analyze the operator performances as far as teleoperation ergonomics is concerned. The objectives of the tests performed are reviewed and an in-depth description of the test facility is given. Strong emphasis is put on test results. ESA

**N90-24304#** British Aerospace Dynamics Group, Bristol (England). Dept. of Human Factors.

### **A FLEXIBLE TELEOPERATION TEST BED FOR HUMAN FACTORS EXPERIMENTATION**

J. L. EVANS and I. G. D. STRACHAN (United Kingdom Atomic Energy Authority, Culham, England) /in ESA, Second European In-Orbit Operations Technology Symposium p 167-171 Dec. 1989

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Research conducted for the European Space Agency in the field of teleoperation is described. The overall aim was to design and build a telerobotic test bed which could be used for experimental investigations of the remote control of robotic manipulator in space from a ground control station. The development of the test bed, and in particular, the development of a General Purpose Robot Controller (GPRC) is described. This permitted the simultaneous control of all 6 degrees of freedom of the experimental robot. The human factors experiments which were

conducted using the test bed are described. A brief summary of the principal results and conclusions is provided. ESA

**N90-24305#** Tohoku Univ., Sendai (Japan). Dept. of Precision Engineering.

### **TELEOPERATION OF A FORCE CONTROLLED ROBOT MANIPULATOR WITHOUT FORCE FEEDBACK TO A HUMAN OPERATOR**

MASARU UCHIYAMA and KOSEI KITAGAKI /in ESA, Second European In-Orbit Operations Technology Symposium p 173-179 Dec. 1989 Sponsored in part by Ministry of Education, Science and Culture, Japan

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A teleoperation scheme of a manipulator in orbit is presented. The scheme uses no force reflection to a human operator on the ground. Instead, the manipulator is hybrid controlled: forces or velocities of the end-effector are selectively controlled. The force or velocity control modes are automatically selected by monitoring forces measured by a force/torque sensor at the wrist of the manipulator. The human operator uses only a joy stick consisting of a force/torque sensor to send commands to the manipulator. The commands are interpreted as force commands or velocity commands by the manipulator. A coefficient to convert the commands into the velocity commands is calculated theoretically based on an index to evaluate the control of collision. The scheme is implemented by a robot system on the ground. Experimental results to show its feasibility are obtained. ESA

**N90-24307#** MATRA Espace, Paris-Velizy (France).

### **THE BI-ARM SERVICER: A MULTIMISSIION CONCEPT AND A TECHNOLOGICAL MODEL FOR SPACE ROBOTICS**

G. ANDRE, G. BERGER, and A. ELFVING (European Space Agency, European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) /in ESA, Second European In-Orbit Operations Technology Symposium p 191-204 Dec. 1989

(Contract ESTEC-7946/87)

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The Bi-Arm Servicer (BIAS) concept: its potential application, its conceptual design and associated system and feasibility analyses, is presented. An application review where four different mission configurations, depending on the carrier type, were investigated, is given. A model mission including a reference environment and reference tasks is established and an overview of the major requirements for the BIAS system is given. The conceptual design of the BIAS is presented. The system architecture is based on two main entities: the servicer equipped with two dexterous manipulators and the teleoperation and control station. The key analyses in several disciplines are outlined and geometry, kinematics, dynamics characteristics are investigated. The sensory subsystem, coordination algorithms, and the teleoperation and control architectures are described. Three test beds and on-going demonstration experiments which support the BIAS main study are presented. ESA

**N90-24333#** Tecnomare S.p.A. (Italy).

### **SUPERVISORY CONTROLLED TELEMANNIPULATION AND VISION SYSTEMS FOR INSPECTION AND MAINTENANCE OPERATIONS**

WALTER PRENDIN, DANILO MADDALENA, ANTONIO TERRIBILE, and GIOVANNI SYLOS LABINI (Italian Space Agency, Rome) /in ESA, Second European In-Orbit Operations Technology Symposium p 429-435 Dec. 1989 Sponsored by Commission of the European Communities; Istituto Mobiliare Italiano; AGIP; ANSALDO; European Nuclear Energy Agency; SAIPEM; and Tecnomare S.p.A.

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Characteristics and test results of an innovative telemanipulation system for underwater applications, based on a supervisory control scheme, are described. The system makes use of a new

stereoscopic vision system to measure the workspace geometry before manipulation. The characteristics of the telemanipulation system are: computer assisted control of manipulator motion, sophisticated MMI, capability of performing a wide range of complex tasks. The telemanipulation and vision system were extensively tested and their effectiveness demonstrated through full scale trials. The applicability of these systems to space environment was analyzed in the framework of two contracts on behalf of the Italian Space Agency. ESA

**N90-24481#** European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Life Support and Habitability Section. **THE EUROPEAN EVA SPACESUIT MECHANISMS** GUIDO ALBERTINI *In its* Fourth European Space Mechanisms and Tribology Symposium p 129-133 Mar. 1990 (Contract ESTEC-7790/88/NL/PB(SC)) Copyright Avail: NTIS HC A14/MF A02

The Extravehicular Activities (EVA) spacesuit developed by ESA and ESTEC is described. Protection, mobility, dexterity, visibility, pressurization, atmosphere regulation and thermal control functions are discussed. The shoulder joint, bearings and other joints in the suit are described and shown in diagrammatic form. The gloves and spacesuit rear entry door mechanisms are described and shown in diagrammatic form. The fan/water separator is described and shown in diagrammatic form. The designs represented constitute the technical baseline of the European EVA spacesuit. ESA

**N90-24722#** Dartmouth Coll., Hanover, NH. Dept. of Psychiatry.

**DURIP: IMPROVED EYE MOVEMENT MONITORING CAPABILITIES FOR STUDIES IN VISUAL COGNITION Final Report, 1 Dec. 1988 - 31 Nov. 1989**

ROBERT FENDRICH 27 Feb. 1990 7 p (Contract AF-AFOSR-0191-89; AF PROJ. 3842) (AD-A220355; AFOSR-90-0362TR) Avail: NTIS HC A02/MF A01 CSCL 06/4

We have interfaced the new Image eyetracker with a Hewlett-Packard 1310 large screen display and IBM PC/AT computer. The IBM contains a Data-Translation high speed D/A-A/D board and a vector drawing board. Specialized software has been developed to analyze the characteristics of both pursuit and saccadic eye motions. The investigations described below are representative subset of the studies we are conducting with the eyetracker. GRA

**N90-24723#** Pennsylvania Univ., Philadelphia. Dept. of Computer and Information Science.

**REAL TIME INVERSE KINEMATICS WITH JOINT LIMITS AND SPATIAL CONSTRAINTS Interim Report**

JIANMIN ZHAO and NORMAN I. BADLER 9 Jan. 1989 23 p (Contract DAAL03-89-C-0031; DAAG29-84-9-0027; DAAG29-84-K-0061; NSF MCS-82-19196; NSF IST-86-12984; NSF DMC-85-16114; NSF IRI-84-10413) (AD-A220462; MS-CIS-89-09; GRAPHICS-LAB-27; ARO-26779.9-EL-AI) Avail: NTIS HC A03/MF A01 CSCL 05/8

A configuration of an articulated figure of joints and segments can sometimes be specified as spatial constraints. Constrained parts on the articulated figure are abstracted as end effectors, and the counterparts in the space are abstracted as goals. The goal (constraint) can be as simple as a position, an orientation, a weighted combination of position and orientation, a line, a plane, a direction, and so on, or it could be as complicated as a region in the space. An articulated figure consists of various segments connected together by joints. Each joint has some degrees of freedom which are subject to joint limits and manual adjustment. An efficient algorithm is presented to adjust the joint angles subject to joint limits so that the set of end effectors concurrently attempt to achieve their respective goals. Users specify end effectors and goals: the program computes a final configuration in real time in the sense that actions appear to take no longer than actual physical activities would. If it is impossible to satisfy all the goals owing to

the actual constraints, the program should end up with the best possibility according to the user's assignment of importances to each goal. Author

**N90-24724#** Anacapa Sciences, Inc., Fort Rucker, AL. **A SURVEY OF HUMAN FACTORS METHODOLOGIES AND MODELS FOR IMPROVING THE MAINTAINABILITY DESIGN OF EMERGING ARMY AVIATION SYSTEMS Interim Report, Dec. 1987 - Feb. 1989**

JOHN W. RUFFNER Feb. 1990 73 p (Contract MDA903-87-C-0523; DA PROJ. 2Q2-63007-A-793) (AD-A221159; ASI690-321-89; ARI-TR-878) Avail: NTIS HC A04/MF A01 CSCL 23/2

This report presents the findings of a literature review conducted to identify human factors methods and models that might be used to improve the maintainability of emerging Army aviation systems. Three methods and seven models are reviewed. The three methods are Logistic Support Analysis, Hardware versus Manpower, and Acquisition of Supportable Systems Evaluation Technology. The seven models are the Human Operator Simulator, Microcomputer Systems Analysis of Integrated Networks of Tasks, Sequiturs Workload Analysis System, Task Analysis and Workload, Maintenance Personnel Simulation, Crew Chief, and Profile. A comparison of the methods and models suggests that the Crew Chief and Profile models have the greatest immediate use for improving maintainability design. It is recommended that research be initiated that will evaluate the Crew Chief and Profile models to see if they can be applied to the maintainability design of Army aviation systems; investigate ways in which the other models might be modified and applied to Army aviation maintainer tasks; and begin a program of maintainability research to address Army aviation systems, mission requirements, and operational environments. GRA

**N90-24725#** Letterman Army Inst. of Research, San Francisco, CA. Div. of Ocular Hazards.

**FIELD EVALUATION OF LASER PROTECTIVE EYEWEAR Report, Jun. - Aug. 1989**

GEORGE R. MASTROIANNI, JEFFREY D. GUNZENHAUSER, DAVID A. STAMPER, KATHRYN H. M. KNUDSON, and BRUCE E. STUCK Oct. 1989 57 p (AD-A221324; LAIR-445) Avail: NTIS HC A04/MF A01 CSCL 05/8

A group of seventy soldiers at the National Training Center were issued Ballistic and Laser Protective Spectacles (B-LPS). The soldiers were surveyed after 90 days of B-LPS use, and again after 180 days. A pencil and paper inventory addressing durability, compatibility, and acceptability was administered at both 90 and 180 days; in addition, a photographic analysis of fit was performed at the 90 day point. Results indicated good overall acceptability and excellent durability. Problem areas were identified as susceptibility to abrasion from dust, lack of protection against blowing dust, and incompatibility with the PASGT (Kevlar) and Combat Vehicle Crewman (CVC) helmets. Recommendations for design changes are suggested. GRA

**N90-24975\*#** Armstrong State Coll., Savannah, GA. Dept. of Biology.

**EFFECT OF LOW AIR VELOCITIES ON THERMAL HOMEOSTASIS AND COMFORT DURING EXERCISE AT SPACE STATION OPERATIONAL TEMPERATURE AND HUMIDITY Final Report**

RONALD J. BEUMER *In* Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 1 15 p Dec. 1989 Avail: NTIS HC A09/MF A02 CSCL 05/8

The effectiveness of different low air velocities in maintaining thermal comfort and homeostasis during exercise at space station operational temperature and humidity was investigated. Five male subjects exercised on a treadmill for successive ten minute periods at 60, 71, and 83 percent of maximum oxygen consumption at each of four air velocities, 30, 50, 80, and 120 ft/min, at 22 C and 62 percent relative humidity. No consistent trends or statistically significant differences between air velocities were found in body

weight loss, sweat accumulation, or changes in rectal, skin, and body temperatures. Occurrence of the smallest body weight loss at 120 ft/min, the largest sweat accumulation at 30 ft/min, and the smallest rise in rectal temperature and the greatest drop in skin temperature at 120 ft/min all suggested more efficient evaporative cooling at the highest velocity. Heat storage at all velocities was evidenced by increased rectal and body temperatures; skin temperatures declined or increased only slightly. Body and rectal temperature increases corresponded with increased perception of warmth and slight thermal discomfort as exercise progressed. At all air velocities, mean thermal perception never exceeded warm and mean discomfort, greatest at 30 ft/min, was categorized at worst as uncomfortable; sensation of thermal neutrality and comfort returned rapidly after cessation of exercise. Suggestions for further elucidation of the effects of low air velocities on thermal comfort and homeostasis include larger numbers of subjects, more extensive skin temperature measurements and more rigorous analysis of the data from this study. Author

**N90-24977\*#** Houston Univ., Clear Lake, TX. School of Natural and Applied Sciences.

**IDENTIFYING ATMOSPHERIC MONITORING NEEDS FOR SPACE STATION FREEDOM Final Report**

DENNIS M. CASSERLY /in Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 1 15 p Dec. 1989

Avail: NTIS HC A09/MF A02 CSCL 06/11

The atmospheric monitoring needs for Space Station Freedom were identified by examining the following from an industrial hygiene perspective: the experiences of past missions; ground based tests of proposed life support systems; the unique experimental and manufacturing facilities; the contaminant load model; metabolic production; and a fire. A target list of compounds to be monitored is presented and information is provided relative to the frequency of analysis, concentration ranges, and locations for monitoring probes. Author

**N90-24981\*#** Montana State Univ., Bozeman. Dept. of Chemistry.

**ELECTROCHEMICAL CONTROL OF IODINE DISINFECTANT FOR SPACE TRANSPORTATION SYSTEM AND SPACE STATION POTABLE WATER Final Report**

RICHARD D. GEER /in Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 1 15 p Dec. 1989

Avail: NTIS HC A09/MF A02 CSCL 06/11

An electrochemical microbial check valve method (EC-MCV) for controlling the iodine disinfectant in potable water (PW) for NASA's space operations was proposed. The factors affecting the design and performance of the unit were analyzed. This showed that it would be feasible to construct a recyclable unit in a small volume that will operate in either an iodine removal or addition mode. The EC-MCV should remove active iodine species rapidly from PW, but the rapid delivery rates at end-use may make complete removal of excess I(-) difficult under some conditions. Its performance change with AgI buildup needs to be investigated, as this controls the time for recycling the unit. The EC-MCV has advantages over the passive microbial check valve (MCV) method currently in use, as it would allow precise control of the I2 level and would not introduce excess I(-) to the water. The presence of oxygen in the EC-MCV needs to be investigated as it could affect the efficiency of I2 addition and excess I(-) removal. Author

**N90-24983\*#** Texas Univ., Galveston. Dept. of Physical Therapy.

**RESEARCH IN HUMAN PERFORMANCE RELATED TO SPACE: A COMPILATION OF THREE PROJECTS/PROPOSALS Final Report**

SCOTT M. HASSON /in Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 1 13 p Dec. 1989

Avail: NTIS HC A09/MF A02 CSCL 05/8

Scientific projects were developed in order to maximize performance in space and assure physiological homeostasis upon return. Three projects that are related to this common goal were

either initiated or formulated during the Faculty Fellowship Summer Program. The projects were entitled: (1) Effect of simulated weightlessness (bed rest) on muscle performance and morphology; (2) Effect of submaximal eccentric muscle contractions on muscle injury, soreness and performance: A grant proposal; and (3) Correlation between isolated joint dynamic muscle strength to end-effector strength of the push and pull extravehicular activity (EVA) ratchet maneuver. The purpose is to describe each of these studies in greater detail. Author

**N90-24987\*#** Houston Univ., TX. Dept. of Psychology.

**KNOWLEDGE-BASED CONTROL OF AN ADAPTIVE INTERFACE Final Report**

ROY LACHMAN /in Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 2 12 p Dec. 1989

Avail: NTIS HC A08/MF A01 CSCL 05/8

The analysis, development strategy, and preliminary design for an intelligent, adaptive interface is reported. The design philosophy couples knowledge-based system technology with standard human factors approaches to interface development for computer workstations. An expert system has been designed to drive the interface for application software. The intelligent interface will be linked to application packages, one at a time, that are planned for multiple-application workstations aboard Space Station Freedom. Current requirements call for most Space Station activities to be conducted at the workstation consoles. One set of activities will consist of standard data management services (DMS). DMS software includes text processing, spreadsheets, data base management, etc. Text processing was selected for the first intelligent interface prototype because text-processing software can be developed initially as fully functional but limited with a small set of commands. The program's complexity then can be increased incrementally. The intelligent interface includes the operator's behavior and three types of instructions to the underlying application software are included in the rule base. A conventional expert-system inference engine searches the data base for antecedents to rules and sends the consequents of fired rules as commands to the underlying software. Plans for putting the expert system on top of a second application, a database management system, will be carried out following behavioral research on the first application. The intelligent interface design is suitable for use with ground-based workstations now common in government, industrial, and educational organizations. Author

**N90-24995\*#** Texas Lutheran Coll., Seguin. Dept. of Biology.  
**THE USE OF UNDERWATER DYNAMOMETRY TO EVALUATE TWO SPACE SUITS Final Report**

W. G. SQUIRES /in Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 2 6 p Dec. 1989

Avail: NTIS HC A08/MF A01 CSCL 06/11

Four Astronauts were instrumented and donned one of three extravehicular activity (EVA) suits: the currently in use shuttle suit (STS), the Mark III (MK3), and the AX5. The STS was used as the comparison suit because of approved status. Each subject performed ten different exercises in each suit in three different manners (static, dynamic and fatigue) in two different environments, WETF and KC-135 (KC-135 not completed as of this report). Data were recorded from a flight qualified underwater dynamometer (Cybex power head) with a TEAC multichannel recorder/tape and downloaded into the VAX computer system for analysis. Also direct hard copy strip chart recordings were made for backup comparisons. Data were analyzed using the ANOVA procedure and results were graphed and reported without interpretation to the NASA/JSC ABL manager. Author

**N90-24999\*#** Texas A&M Univ., Galveston. Dept. of Marine Engineering.

**A PRELIMINARY DESIGN OF INTERIOR STRUCTURE AND FOUNDATION OF AN INFLATABLE LUNAR HABITAT Final Report**

PAUL K. YIN /in Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 2 12 p Dec. 1989

Avail: NTIS HC A08/MF A01 CSCL 06/11

A preliminary structural design and analysis of an inflatable habitat for installation on the moon was completed. The concept takes the shape of a sphere with a diameter of approximately 16 meters. The interior framing provides five floor levels and is enclosed by a spherical air-tight membrane holding an interior pressure of 14.7 psi (101.4kpa). The spherical habitat is to be erected on the lunar surface with the lower one third below grade and the upper two thirds covered with a layer of lunar regolith for thermal insulation and shielding against radiation and meteoroids. The total dead weight (earth weight) of the structural aluminum, which is of vital interest for the costly space transportation, is presented. This structural dead weight represents a preliminary estimate without including structural details. The design results in two versions: one supports the weight of the radiation shielding in case of deflation of the fabric enclosure and the other assumes that the radiation shielding is self supporting. To gain some indication of the amount of structural materials needed if the identical habitat were installed on Mars and Earth, three additional design versions were generated where the only difference is in gravity. These additional design versions are highly academic since the difference will be much more than in gravity alone. The lateral loading due to dust storms on Mars and wind loads on Earth are some examples. The designs under the lunar gravity are realistic. They may not be adequate for final material procurement and fabrication, however, as the connection details, among other reasons, may effect the sizes of the structural members. Author

## 55

## SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

**N90-23897\*#** Wisconsin Univ., Milwaukee.

**THE BIOGEOCHEMISTRY OF METAL CYCLING**

KENNETH H. NEALSON, ed., MOLLY NEALSON, ed., and F. RONALD DUTCHER, ed. (George Washington Univ., Washington, DC.) Washington NASA May 1990 220 p  
(Contract NASW-4324)  
(NASA-CR-4295; NAS 1.26:4295) Avail: NTIS HC A10/MF A02  
CSCL 03/2

The results of the Planetary Biology and Microbial Ecology's summer 1987 program are summarized. The purpose of the interdisciplinary PBME program is to integrate, via lectures and laboratory work, the contributions of university and NASA scientists and student interns. The 1987 program examined various aspects of the biogeochemistry of metal cycling, and included such areas as limnology, metal chemistry, metal geochemistry, microbial ecology, and interactions with metals. A particular area of focus was the use of remote sensing in the study of biogeochemistry. Abstracts and bibliographies of the lectures and reports of the laboratory projects are presented. Author

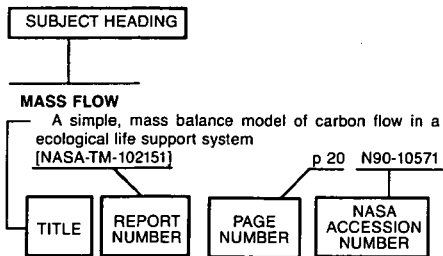
**N90-25058\*#** Montclair State Coll., Upper Montclair, NJ. Dept. of Psychology.

**AN EMPIRICALLY DERIVED FIGURE OF MERIT FOR THE QUALITY OF OVERALL TASK PERFORMANCE**

MOIRA LEMAY /n Old Dominion Univ., NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program 1989 p 111-113 Sep. 1989  
Avail: NTIS HC A09/MF A02 CSCL 05/8

The need to develop an operationally relevant figure of merit for the quality of performance of a complex system such as an aircraft cockpit stems from a hypothesized dissociation between measures of performance and those of workload. Performance can be measured in terms of time, errors, or a combination of these. In most tasks performed by expert operators, errors are relatively rare and often corrected in time to avoid consequences. Moreover, perfect performance is seldom necessary to accomplish a particular task. Moreover, how well an expert performs a complex task consisting of a series of discrete cognitive tasks superimposed on a continuous task, such as flying an aircraft, does not depend on how well each discrete task is performed, but on their smooth sequencing. This makes the amount of time spent on each subtask of paramount importance in measuring overall performance, since smooth sequencing requires a minimum amount of time spent on each task. Quality consists in getting tasks done within a crucial time interval while maintaining acceptable continuous task performance. Thus, a figure of merit for overall quality of performance should be primarily a measure of time to perform discrete subtasks combined with a measure of basic vehicle control. Thus, the proposed figure of merit requires doing a task analysis on a series of performance, or runs, of a particular task, listing each discrete task and its associated time, and calculating the mean and standard deviation of these times, along with the mean and standard deviation of tracking error for the whole task. A set of simulator data on 30 runs of a landing task was obtained and a figure of merit will be calculated for each run. The figure of merit will be compared for voice and data link, so that the impact of this technology on total crew performance (not just communication performance) can be assessed. The effect of data link communication on other cockpit tasks will also be considered. Author

## Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of document content, a title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

## A

### ABILITIES

- Pilots' perception of risks and hazards in general aviation p 253 A90-39641
- The incremental validity of spatial and perceptual-psychomotor tests relative to the armed services vocational aptitude battery [AD-A220903] p 256 N90-24719

### ABNORMALITIES

- Decompression sickness affecting the temporomandibular joint [AD-A220959] p 250 N90-24715

### ABSTRACTS

- The biogeochemistry of metal cycling [NASA-CR-4295] p 265 N90-23897

### ACCELERATION (PHYSICS)

- Brain stem evoked responses in altered G environments [AD-A220097] p 249 N90-23874

### ACCELERATION TOLERANCE

- Rheoencephalography in simulated aviation environmental stress [AD-A221150] p 250 N90-24716

### ACID BASE EQUILIBRIUM

- Effects of high altitude hypoxia on lung and chest wall function during exercise [AD-A219814] p 248 N90-23869

### ACOUSTIC MEASUREMENT

- Voice measures of workload in the advanced flight deck: Additional studies [NASA-CR-4258] p 259 N90-23887

### ACOUSTICS

- Analyses of the predictability of noise-induced sleep disturbance [AD-A220156] p 249 N90-23876
- Mental lapses and event-related potentials [AD-A219454] p 254 N90-23878

### ADENOSINE TRIPHOSPHATE

- Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity p 251 N90-24993

### ADRENERGICS

- Analysis of neural systems involved in modulation of memory storage [AD-A220230] p 250 N90-24714

### AEROSINUSITIS

- Recurrent sinusitis and impairment of eustachian tube function in air passengers and crew p 247 A90-39649

### AEROSPACE ENGINEERING

- Strategic implementation plan [NASA-SP-7011(336)] p 244 N90-23861

### AEROSPACE MEDICINE

- Biological and cognitive determination of the gravitational reference frame p 253 A90-39828
- Effects of spaceflight on levels and activity of immune cells p 243 A90-39647
- Strategic implementation plan [NASA-TM-102907] p 244 N90-23861
- Aerospace medicine and biology: A continuing bibliography with indexes (supplement 336) [NASA-SP-7011(336)] p 249 N90-23877

### AIR TRAFFIC CONTROL

- Effects of monitoring under high and low taskload on detection of flashing and colored radar targets [AD-A220313] p 260 N90-23895

### AIR TRAFFIC CONTROLLERS (PERSONNEL)

- Effects of monitoring under high and low taskload on detection of flashing and colored radar targets [AD-A220313] p 260 N90-23895
- From where they look to what they think: Determining controller cognitive strategies from oculometer scanning data p 256 N90-25041

### AIRCRAFT MAINTENANCE

- A survey of human factors methodologies and models for improving the maintainability design of emerging Army aviation systems [AD-A221159] p 263 N90-24724

### AIRCRAFT NOISE

- Analyses of the predictability of noise-induced sleep disturbance [AD-A220156] p 249 N90-23876

### AIRCRAFT PILOTS

- Pilots' perception of risks and hazards in general aviation p 253 A90-39641
- Designing the virtual cockpit man-machine interface p 258 A90-40389
- Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 254 A90-42455
- Activities report of the National Aerospace Medical Center [ETN-90-96936] p 256 N90-24721

### AIRSPACE

- Effects of monitoring under high and low taskload on detection of flashing and colored radar targets [AD-A220313] p 260 N90-23895

### ALERTNESS

- High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

### ALGORITHMS

- Neuromorphic optical signal processing and image understanding for automated target recognition [AD-A219827] p 255 N90-23884
- Real time inverse kinematics with joint limits and spatial constraints [AD-A220462] p 263 N90-24723

### ALTITUDE SICKNESS

- Biological and cognitive determination of the gravitational reference frame p 253 A90-39828

### ALTITUDE SIMULATION

- Decompression sickness affecting the temporomandibular joint [AD-A220959] p 250 N90-24715

### AMPHETAMINES

- Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644

### ANTHROPOMETRY

- The application of kriging in the statistical analysis of anthropometric data, volume 1 [AD-A220613] p 260 N90-23891
- The application of kriging in the statistical analysis of anthropometric data, volume 2 [AD-A220614] p 260 N90-23892
- The application of kriging in the statistical analysis of anthropometric data, volume 3 [AD-A220615] p 260 N90-23893
- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1 [AD-A218614] p 250 N90-24713

### ANTISEPTICS

- Electrochemical control of iodine disinfectant for space transportation system and space station potable water p 264 N90-24981

### APERTURES

- Optical factors in judgments of size through an aperture p 254 A90-42289

### APPLICATIONS PROGRAMS (COMPUTERS)

- Knowledge-based control of an adaptive interface p 264 N90-24987

### APTITUDE

- The incremental validity of spatial and perceptual-psychomotor tests relative to the armed services vocational aptitude battery [AD-A220903] p 256 N90-24719

### ARCHAEBACTERIA

- Model of carbon fixation in microbial mats from 3,500 Myr ago to the present p 243 A90-39821

### ARCHITECTURE (COMPUTERS)

- The Hermes robot arm teleoperation and control concept p 261 N90-24301
- The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307

### ARTIFICIAL INTELLIGENCE

- Neuromorphic optical signal processing and image understanding for automated target recognition [AD-A219827] p 255 N90-23884

### ASTRONAUT LOCOMOTION

- The European EVA spacesuit mechanisms p 263 N90-24481

### ASTRONAUT PERFORMANCE

- Relationships between orientation, movement and posture in weightlessness - Preliminary ethological observations p 246 A90-39829
- Study of acute hypoxic effect on human performance under aerospace conditions p 246 A90-39321

### ASTRONAUTS

- The use of underwater dynamometry to evaluate two space suits p 264 N90-24995

### ATMOSPHERIC TEMPERATURE

- Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity p 263 N90-24975

### ATROPINE

- Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys [AD-A219455] p 244 N90-23862

### ATTENTION

- Proximity compatibility and information display - Effects of color, space, and objectness on information integration p 254 A90-42287
- DURIP: Improved eye movement monitoring capabilities for studies in visual cognition [AD-A220355] p 263 N90-24722

### AUDIO FREQUENCIES

- Perception of complex auditory patterns [AD-A219626] p 248 N90-23867

### AUDITORY PERCEPTION

- Perception of complex auditory patterns [AD-A219626] p 248 N90-23867
- Auditory perception of complex sounds [AD-A219927] p 249 N90-23872

### AUDITORY SIGNALS

- Perception of complex auditory patterns [AD-A219626] p 248 N90-23867



## AUDITORY STIMULI

- Brain stem evoked responses in altered G environments  
[AD-A220097] p 249 N90-23874
- AUTONOMIC NERVOUS SYSTEM**  
Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862

## B

## BAYES THEOREM

- The application of kriging in the statistical analysis of anthropometric data, volume 1  
[AD-A220613] p 260 N90-23891

## BED REST

- Hormonal regulation of fluid and electrolytes during prolonged bed rest - Implications for microgravity  
p 247 A90-40750
- Noninvasive estimation of fluid shifts between body compartments by measurement of bioelectric characteristics  
p 251 N90-24976
- Research in human performance related to space: A compilation of three projects/proposals  
p 264 N90-24983

## BEHAVIOR

- Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862

## BIBLIOGRAPHIES

- Aerospace medicine and biology: A continuing bibliography with indexes (supplement 336)  
[NASA-SP-7011(336)] p 249 N90-23877
- The biogeochemistry of metal cycling  
[NASA-CR-4295] p 265 N90-23897

## BINOCULAR VISION

- Limits of fusion and depth judgment in stereoscopic color displays  
p 254 A90-42286

## BIOASTRONAUTICS

- Aerospace medicine and biology: A continuing bibliography with indexes (supplement 336)  
[NASA-SP-7011(336)] p 249 N90-23877

## BIOCHEMISTRY

- Neurotransmitter and peptide localization in human brain  
[AD-A219964] p 249 N90-23873

## BIODYNAMICS

- Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics  
p 243 A90-39646
- Effects of biodynamic coupling on the human operator model  
p 258 A90-40161

## BIOELECTRICITY

- Cortical microstimulation influences perceptual judgements of motion direction  
p 244 A90-41874
- Noninvasive estimation of fluid shifts between body compartments by measurement of bioelectric characteristics  
p 251 N90-24976

## BIOENGINEERING

- Electronic modulation of biomaterial functions  
p 244 A90-41265

## BIOGEOCHEMISTRY

- Model of carbon fixation in microbial mats from 3,500 Myr ago to the present  
p 243 A90-39821
- The biogeochemistry of metal cycling  
[NASA-CR-4295] p 265 N90-23897

## BIOSYSTEMS

- Biosensors for the detection of heavy metal ions  
[MBB-Z-0289-89-PUB] p 245 N90-23864

## BIOLOGICAL EFFECTS

- Aerospace medicine and biology: A continuing bibliography with indexes (supplement 336)  
[NASA-SP-7011(336)] p 249 N90-23877

## BIOLOGICAL MODELS (MATHEMATICS)

- Effects of biodynamic coupling on the human operator model  
p 258 A90-40161

## BIOEFFECTORS

- The effects of simulated hypogravity on murine bone marrow cells  
p 251 N90-24989

## BIOSPHERE

- Biophysical and clinical aspects of heliobiology: Collection of scientific works  
p 244 A90-41954
- Strategic implementation plan  
[NASA-TM-102907] p 244 N90-23861

## BIOTECHNOLOGY

- Understanding our genetic inheritance. The US Human genome project: The first five years, FY 1991-1995  
[DE90-008240] p 250 N90-24718

## BODY FLUIDS

- Hormonal regulation of fluid and electrolytes during prolonged bed rest - Implications for microgravity  
p 247 A90-40750
- Noninvasive estimation of fluid shifts between body compartments by measurement of bioelectric characteristics  
p 251 N90-24976

- Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity  
p 251 N90-24993

## BODY TEMPERATURE

- Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity  
p 263 N90-24975

## BODY WEIGHT

- Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels  
p 244 A90-41819
- Effect of body suspension hypokinesia on skeletal muscle trained previously by endurance exercise  
p 244 A90-41820

## BONE DEMINERALIZATION

- Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity  
p 251 N90-24993

## BONE MARROW

- The effects of simulated hypogravity on murine bone marrow cells  
p 251 N90-24989

## BONES

- Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics  
p 243 A90-39646

## BRAIN

- Oxidative phosphorylation system during steady-state hypoxia in the dog brain  
p 243 A90-40074
- DURIP-Instrumentation for recording and analyzing multiple input/output saccadic eye movement neurosensory control  
[AD-A219905] p 248 N90-23871
- Neurotransmitter and peptide localization in human brain  
[AD-A219964] p 249 N90-23873
- Analysis of neural systems involved in modulation of memory storage  
[AD-A220230] p 250 N90-24714

## BRAIN STEM

- Brain stem evoked responses in altered G environments  
[AD-A220097] p 249 N90-23874

## BRIGHTNESS TEMPERATURE

- A laboratory study of the effects of diet and bright light countermeasures to jet lag  
[AD-A220148] p 249 N90-23875

## BROMIDES

- Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862
- Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology  
[AD-A221222] p 250 N90-24717

## C

## CABIN ATMOSPHERES

- Life support system - Dorniers contribution for space applications  
p 258 A90-41116

## CAFFEINE

- A laboratory study of the effects of diet and bright light countermeasures to jet lag  
[AD-A220148] p 249 N90-23875

## CALCIUM

- Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity  
p 251 N90-24993

## CARBON

- Model of carbon fixation in microbial mats from 3,500 Myr ago to the present  
p 243 A90-39821

## CARDIOVASCULAR SYSTEM

- Effect of fluid countermeasures of varying osmolality on cardiovascular responses to orthostatic stress  
p 251 N90-24978

## CATALOGS (PUBLICATIONS)

- A systematic approach to training: A training needs assessment  
p 257 N90-25059

## CATHODE RAY TUBES

- Effect of extraneous color-coded targets on identification of targets on CRT displays  
[AD-A219473] p 254 N90-23879

## CELL MEMBRANES (BIOLOGY)

- Electronic modulation of biomaterial functions  
p 244 A90-41265

## CELLS (BIOLOGY)

- Effects of spaceflight on levels and activity of immune cells  
p 243 A90-39647
- The effects of simulated hypogravity on murine bone marrow cells  
p 251 N90-24989

## CENTRAL NERVOUS SYSTEM

- Reciprocal relationships between the immune and central nervous system  
[AD-A221259] p 245 N90-24712

## CENTRIFUGAL FORCE

- Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels  
p 244 A90-41819

## CENTRIFUGING STRESS

- High +Gz centrifuge training - The electrocardiographic response to +Gz-induced loss of consciousness  
p 246 A90-39643

## CEREBRAL CORTEX

- Cortical microstimulation influences perceptual judgements of motion direction  
p 244 A90-41874

## CEREBROSPINAL FLUID

- Rheoencephalography in simulated aviation environmental stress  
[AD-A221150] p 250 N90-24716

## CHEMICAL ATTACK

- Effects of pyridostigmine bromide on in-flight aircrew performance  
p 247 A90-42288

## CHEMICAL DEFENSE

- Effects of pyridostigmine bromide on in-flight aircrew performance  
p 247 A90-42288
- Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology  
[AD-A221222] p 250 N90-24717

## CHOLINE

- Neurotransmitter and peptide localization in human brain  
[AD-A219964] p 249 N90-23873

## CHOLINERGICS

- Analysis of neural systems involved in modulation of memory storage  
[AD-A220230] p 250 N90-24714

## CLINICAL MEDICINE

- Biophysical and clinical aspects of heliobiology: Collection of scientific works  
p 244 A90-41954

## CLOSED ECOLOGICAL SYSTEMS

- Strategic implementation plan  
[NASA-TM-102907] p 244 N90-23861

## COCKPIT SIMULATORS

- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888

## COCKPITS

- Effects of biodynamic coupling on the human operator model  
p 258 A90-40161
- Designing the virtual cockpit man-machine interface  
p 258 A90-40389

## COGNITION

- Hand shaping: A paradigm for cognitive/motoric interaction  
[AD-A219908] p 255 N90-23885
- DURIP: Computational modeling of cognitive processes  
[AD-A219934] p 255 N90-23886
- DURIP: Improved eye movement monitoring capabilities for studies in visual cognition  
[AD-A220355] p 263 N90-24722
- From where they look to what they think: Determining controller cognitive strategies from oculometer scanning data  
p 256 N90-25041

## COGNITIVE PSYCHOLOGY

- Relationships between orientation, movement and posture in weightlessness - Preliminary ethological observations  
p 246 A90-38929

## COLLISION AVOIDANCE

- Effects of monitoring under high and low taskload on detection of flashing and colored radar targets  
[AD-A220313] p 260 N90-23895

## COLOR CODING

- Proximity compatibility and information display - Effects of color, space, and objectness on information integration  
p 254 A90-42287
- Effect of extraneous color-coded targets on identification of targets on CRT displays  
[AD-A219473] p 254 N90-23879

## COLOR VISION

- Eleven colors that are almost never confused  
p 253 A90-38871
- Unified model for human color perception and visual adaptation  
p 253 A90-38872
- Critical color differences determined with a visual search task  
p 253 A90-40264
- Cortical microstimulation influences perceptual judgements of motion direction  
p 244 A90-41874

## COLUMBUS SPACE STATION

- HERA and EVA co-operation scenarios  
p 261 N90-24299
- Robot-based equipment manipulation and transportation for the Columbus free flying laboratory  
p 261 N90-24300

## COMPLEXITY

- Auditory perception of complex sounds  
[AD-A219927] p 249 N90-23872

## COMPUTER GRAPHICS

- Visions of visualization aids - Design philosophy and observations  
p 257 A90-38859

Scientific work environments in the next decade  
p 257 A90-38860

Human vision, visual processing, and digital display;  
Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20,  
1989  
[SPIE-1077] p 252 A90-38864

**COMPUTER PROGRAMS**  
The application of kriging in the statistical analysis of  
anthropometric data, volume 3  
[AD-A220615] p 260 N90-23893

**COMPUTER VISION**  
A new paradigm for testing human and machine motion  
perception p 252 A90-38868

**COMPUTERIZED SIMULATION**  
Analysis of the accuracy of a proposed target motion  
analysis procedure  
[AD-A219481] p 254 N90-23880  
A survey of human factors methodologies and models  
for improving the maintainability design of emerging Army  
aviation systems  
[AD-A221159] p 263 N90-24724

**COMPUTERS**  
DURIP-Instrumentation for recording and analyzing  
multiple input/output saccadic eye movement  
neurosensory control  
[AD-A219905] p 248 N90-23871

**CONFERENCES**  
Human vision, visual processing, and digital display;  
Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20,  
1989  
[SPIE-1077] p 252 A90-38864  
DURIP: Computational modeling of cognitive  
processes  
[AD-A219934] p 255 N90-23886

**CONSERVATION**  
Conservation of body calcium by increased dietary intake  
of potassium: A potential measure to reduce the  
osteoporosis process during prolonged exposure to  
microgravity p 251 N90-24993

**CONSUMPTION**  
A laboratory study of the effects of diet and bright light  
countermeasures to jet lag  
[AD-A220148] p 249 N90-23875

**CONTAMINANTS**  
Identifying atmospheric monitoring needs for Space  
Station Freedom p 264 N90-24977

**CONTRAST**  
Dazzling glare: Protection criteria versus visual  
performance  
[AD-A219676] p 259 N90-23889

**CONTROL SIMULATION**  
Pilot decision-making training  
[AD-A221349] p 256 N90-24720

**CONTROL STICKS**  
Teleoperation of a force controlled robot manipulator  
without force feedback to a human operator  
p 262 N90-24305

**CONTROL SYSTEMS DESIGN**  
Teleoperation of a force controlled robot manipulator  
without force feedback to a human operator  
p 262 N90-24305  
The bi-arm servicer: A multimission concept and a  
technological model for space robotics  
p 262 N90-24307  
Supervisory controlled telemanipulation and vision  
systems for inspection and maintenance operations  
p 262 N90-24333

**CONTROL THEORY**  
The Hermes robot arm teleoperation and control  
concept p 261 N90-24301

**COST ANALYSIS**  
Lunar shelter  
[ILR-MITT-233(1989)] p 260 N90-23896

**COUNTERMEASURES**  
Effect of fluid countermeasures of varying osmolarity  
on cardiovascular responses to orthostatic stress  
p 251 N90-24978

**CREW PROCEDURES (INFLIGHT)**  
Effects of pyridostigmine bromide on in-flight aircrew  
performance p 247 A90-42288

**CREWS**  
A comparative analysis of work-hour forecasting  
techniques at the crew level  
[AD-A220706] p 260 N90-23894

**CRYSTAL GROWTH**  
Preliminary crystallographic examination of a novel  
fungal lysozyme from Chalaropsis p 243 A90-40377

**CRYSTAL STRUCTURE**  
Preliminary crystallographic examination of a novel  
fungal lysozyme from Chalaropsis p 243 A90-40377

**CUES**  
Superimposed perspective visual cues for helicopter  
hovering above a moving ship deck p 254 A90-42455

**CYCLES**  
The biogeochemistry of metal cycling  
[NASA-CR-4295] p 265 N90-23897

**CYTOMETRY**  
The effects of simulated hypogravity on murine bone  
marrow cells p 251 N90-24989

**D**

**DATA ACQUISITION**  
Visions of visualization aids - Design philosophy and  
observations p 257 A90-38859

**DATA BASE MANAGEMENT SYSTEMS**  
Knowledge-based control of an adaptive interface  
p 264 N90-24987

**DATA BASES**  
Knowledge-based control of an adaptive interface  
p 264 N90-24987

**DATA MANAGEMENT**  
Knowledge-based control of an adaptive interface  
p 264 N90-24987

**DECISION MAKING**  
Perception of complex auditory patterns  
[AD-A219626] p 248 N90-23867  
Pilot decision-making training  
[AD-A221349] p 256 N90-24720

**DECOMPRESSION SICKNESS**  
Rapid decompression to 50,000 feet - Effect on heart  
rate response p 246 A90-39642  
Decompression sickness affecting the  
temporomandibular joint  
[AD-A220959] p 250 N90-24715

**DEGREES OF FREEDOM**  
Real time inverse kinematics with joint limits and spatial  
constraints  
[AD-A220462] p 263 N90-24723

**DEHYDRATION**  
Effect of fluid countermeasures of varying osmolarity  
on cardiovascular responses to orthostatic stress  
p 251 N90-24978

**DEOXYRIBONUCLEIC ACID**  
In vitro photoreactivation of transforming DNA of bacillus  
subtilis spores after irradiation with UV light  
[DLR-FB-89-45] p 245 N90-24710  
Understanding our genetic inheritance. The US Human  
genome project: The first five years, FY 1991-1995  
[DE90-008240] p 250 N90-24718

**DESENSITIZING**  
Effects of cold and capsaicin desensitization on  
prostaglandin E hypothermia in rats p 243 A90-40075

**DESIGN ANALYSIS**  
The European EVA spacesuit mechanisms  
p 263 N90-24481  
A survey of human factors methodologies and models  
for improving the maintainability design of emerging Army  
aviation systems  
[AD-A221159] p 263 N90-24724

**DETECTION**  
Biosensors for the detection of heavy metal ions  
[MBB-Z-0289-89-PUB] p 245 N90-23864  
Perception of complex auditory patterns  
[AD-A219626] p 248 N90-23867

**DIETS**  
A laboratory study of the effects of diet and bright light  
countermeasures to jet lag  
[AD-A220148] p 249 N90-23875  
Conservation of body calcium by increased dietary intake  
of potassium: A potential measure to reduce the  
osteoporosis process during prolonged exposure to  
microgravity p 251 N90-24993

**DIMENSIONS**  
Adding a dimension: Time as a factor in the  
generalizability of predictive relationships  
[AD-A219679] p 259 N90-23890

**DISPLAY DEVICES**  
Low cost design alternatives for head mounted  
stereoscopic displays p 257 A90-38853  
Perceptual issues in scientific visualization  
p 252 A90-38858  
Human vision, visual processing, and digital display;  
Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20,  
1989  
[SPIE-1077] p 252 A90-38864  
Eleven colors that are almost never confused  
p 253 A90-38871  
Designing the virtual cockpit man-machine interface  
p 258 A90-40389  
Limits of fusion and depth judgment in stereoscopic color  
displays p 254 A90-42286  
Proximity compatibility and information display - Effects  
of color, space, and objectness on information  
integration p 254 A90-42287  
Effect of extraneous color-coded targets on identification  
of targets on CRT displays  
[AD-A219473] p 254 N90-23879

**DIVING (UNDERWATER)**  
Field management of accidental hypothermia during  
diving  
[AD-A219560] p 247 N90-23866

**DOSAGE**  
Effects of cholinergic drugs on exercise performance  
and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862

**DRINKING**  
Effect of fluid countermeasures of varying osmolarity  
on cardiovascular responses to orthostatic stress  
p 251 N90-24978

**DYNAMIC TESTS**  
The use of underwater dynamometry to evaluate two  
space suits p 264 N90-24995

**E**

**EDUCATION**  
A systematic approach to training: A training needs  
assessment p 257 N90-25059

**EFFERENT NERVOUS SYSTEMS**  
Relationships between orientation, movement and  
posture in weightlessness - Preliminary ethological  
observations p 246 A90-38929

**ELECTRICAL MEASUREMENT**  
Noninvasive estimation of fluid shifts between body  
compartments by measurement of bioelectric  
characteristics p 251 N90-24976

**ELECTRICAL RESISTANCE**  
Noninvasive estimation of fluid shifts between body  
compartments by measurement of bioelectric  
characteristics p 251 N90-24976

**ELECTROCARDIOGRAPHY**  
High + Gz centrifuge training - The electrocardiographic  
response to +Gz-induced loss of consciousness  
p 246 A90-39643

**ELECTROCHEMISTRY**  
Electrochemical control of iodine disinfectant for space  
transportation system and space station potable water  
p 264 N90-24981

**ELECTROLYTE METABOLISM**  
Hormonal regulation of fluid and electrolytes during  
prolonged bed rest - Implications for microgravity  
p 247 A90-40750

**ELECTROLYTES**  
Conservation of body calcium by increased dietary intake  
of potassium: A potential measure to reduce the  
osteoporosis process during prolonged exposure to  
microgravity p 251 N90-24993

**ELECTROMAGNETIC PULSES**  
High peak power microwave pulses at 2.37 GHz: No  
effects on vigilance performance in monkeys  
[AD-A219570] p 245 N90-23863

**ELECTROPHYSIOLOGY**  
Brain stem evoked responses in altered G  
environments  
[AD-A220097] p 249 N90-23874

**END EFFECTORS**  
Real time inverse kinematics with joint limits and spatial  
constraints  
[AD-A220462] p 263 N90-24723

**ENVIRONMENT SIMULATORS**  
Effects of pyridostigmine bromide on in-flight aircrew  
performance p 247 A90-42288

**ENVIRONMENTAL MONITORING**  
Identifying atmospheric monitoring needs for Space  
Station Freedom p 264 N90-24977

**ENZYME ACTIVITY**  
Conservation of body calcium by increased dietary intake  
of potassium: A potential measure to reduce the  
osteoporosis process during prolonged exposure to  
microgravity p 251 N90-24993

**ENZYMES**  
Electronic modulation of biomaterial functions  
p 244 A90-41265

**EUSTACHIAN TUBES**  
Recurrent sinusitis and impairment of eustachian tube  
function in air passengers and crew p 247 A90-39649

**EVOKED RESPONSE (PSYCHOPHYSIOLOGY)**  
Mental lapses and event-related potentials  
[AD-A219454] p 254 N90-23878

**EXERCISE PHYSIOLOGY**  
Overtraining and exercise motivation: A research  
prospectus p 256 N90-24982

**EXOBIOLGY**  
Strategic implementation plan  
[NASA-TM-102907] p 244 N90-23861  
Aerospace medicine and biology: A continuing  
bibliography with indexes (supplement 336)  
[NASA-SP-7011(336)] p 249 N90-23877

**EXPERIENCE**  
Target selection in anti-tank operations: Effects of  
experience  
[FOA-C-50073-5.2] p 255 N90-23882

## EXPERT SYSTEMS

- Knowledge-based control of an adaptive interface  
p 264 N90-24987

## EXPOSURE

- High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys  
[AD-A219570] p 245 N90-23863
- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868
- Analyses of the predictability of noise-induced sleep disturbance  
p 249 N90-23876
- Dazzling glare: Protection criteria versus visual performance  
[AD-A219676] p 259 N90-23889

## EXTRAVEHICULAR ACTIVITY

- A prototype autonomous agent for crew and equipment retrieval in space  
p 259 A90-41198
- The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations  
p 261 N90-24296
- Telerobotic application to EVA  
p 261 N90-24298
- The European EVA spacesuit mechanisms  
p 263 N90-24481
- The use of underwater dynamometry to evaluate two space suits  
p 264 N90-24995

## EYE (ANATOMY)

- DURIP-Instrumentation for recording and analyzing multiple input/output saccadic eye movement neurosensory control  
[AD-A219905] p 248 N90-23871
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- DURIP: Improved eye movement monitoring capabilities for studies in visual cognition  
[AD-A220355] p 263 N90-24722

## EYE MOVEMENTS

- DURIP: Improved eye movement monitoring capabilities for studies in visual cognition  
[AD-A220355] p 263 N90-24722

## EYE PROTECTION

- Eye centered interferometric laser protection  
p 258 A90-40390
- A new approach to laser filters  
p 258 A90-40391
- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868
- Dazzling glare: Protection criteria versus visual performance  
[AD-A219676] p 259 N90-23889
- Field evaluation of laser protective eyewear  
[AD-A221324] p 263 N90-24725

## F

## FABRICS

- A preliminary design of interior structure and foundation of an inflatable lunar habitat  
p 264 N90-24999

## FATIGUE (BIOLOGY)

- On-line estimation of human operator workload  
p 258 A90-40839

## FIELD OF VIEW

- Alternative representations of visual space  
p 252 A90-38861

## FIGURE OF MERIT

- An empirically derived figure of merit for the quality of overall task performance  
p 265 N90-25058

## FINGERS

- Hand shaping: A paradigm for cognitive/motoric interaction  
[AD-A219908] p 255 N90-23885

## FIR FILTERS

- On-line estimation of human operator workload  
p 258 A90-40839

## FLASH BLINDNESS

- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868

## FLIGHT CREWS

- Recurrent sinusitis and impairment of eustachian tube function in air passengers and crew  
p 247 A90-39649
- Effects of pyridostigmine bromide on in-flight aircrew performance  
p 247 A90-42288
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- The application of kriging in the statistical analysis of anthropometric data, volume 1  
[AD-A220613] p 260 N90-23891
- Pilots' perception of risks and hazards in general aviation  
p 253 A90-39641

## FLIGHT OPERATIONS

- Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations  
p 261 N90-24297

## FLIGHT SAFETY

- Human factors and safety considerations of night vision systems flight  
p 258 A90-40380

## FLIGHT SIMULATORS

- Voice measures of workload in the advanced flight deck: Additional studies  
[NASA-CR-4258] p 259 N90-23887

## FORECASTING

- A comparative analysis of work-hour forecasting techniques at the crew level  
[AD-A220706] p 260 N90-23894

## FUNGI

- Preliminary crystallographic examination of a novel fungal lysozyme from Chalaropsis  
p 243 A90-40377

## G

## GAS EXCHANGE

- Effects of high altitude hypoxia on lung and chest wall function during exercise  
[AD-A219814] p 248 N90-23869

## GENETIC ENGINEERING

- Understanding our genetic inheritance. The US Human genome project: The first five years, FY 1991-1995  
[DE90-008240] p 250 N90-24718

## GENETICS

- Understanding our genetic inheritance. The US Human genome project: The first five years, FY 1991-1995  
[DE90-008240] p 250 N90-24718

## GEOCHEMISTRY

- The biogeochemistry of metal cycling  
[NASA-CR-4295] p 265 N90-23897

## GEOMAGNETISM

- Biophysical and clinical aspects of heliobiology: Collection of scientific works  
p 244 A90-41954

## GLARE

- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- Dazzling glare: Protection criteria versus visual performance  
[AD-A219676] p 259 N90-23889

## GOGGLES

- The application of kriging in the statistical analysis of anthropometric data, volume 1  
[AD-A220613] p 260 N90-23891
- The application of kriging in the statistical analysis of anthropometric data, volume 2  
[AD-A220614] p 260 N90-23892
- The application of kriging in the statistical analysis of anthropometric data, volume 3  
[AD-A220615] p 260 N90-23893
- Field evaluation of laser protective eyewear  
[AD-A221324] p 263 N90-24725

## GONDOLAS

- Vestibulo-ocular responses in man to +Gz hypergravity  
p 246 A90-39645

## GRAVITATIONAL PHYSIOLOGY

- Biological and cognitive determination of the gravitational reference frame  
p 253 A90-38928
- High +Gz centrifuge training - The electrocardiographic response to +Gz-induced loss of consciousness  
p 246 A90-39643
- Hormonal regulation of fluid and electrolytes during prolonged bed rest - Implications for microgravity  
p 247 A90-40750
- Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity  
p 251 N90-24993

## H

## HABITATS

- A preliminary design of interior structure and foundation of an inflatable lunar habitat  
p 264 N90-24999

## HAND (ANATOMY)

- Hand shaping: A paradigm for cognitive/motoric interaction  
[AD-A219908] p 255 N90-23885

## HAZARDS

- Evaluation of the head injury hazard during military parachuting  
[AD-A220724] p 248 N90-23870

## HEAD (ANATOMY)

- Evaluation of the head injury hazard during military parachuting  
[AD-A220724] p 248 N90-23870
- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1  
[AD-A218614] p 250 N90-24713
- Rheoencephalography in simulated aviation environmental stress  
[AD-A221150] p 250 N90-24716

## HEAD-UP DISPLAYS

- Low cost design alternatives for head mounted stereoscopic displays  
p 257 A90-38853
- Superimposed perspective visual cues for helicopter hovering above a moving ship deck  
p 254 A90-42455

## HEARING

- Perception of complex auditory patterns  
[AD-A219626] p 248 N90-23867

## HEART FUNCTION

- Effect of fluid countermeasures of varying osmolarity on cardiovascular responses to orthostatic stress  
p 251 N90-24978

## HEART RATE

- Rapid decompression to 50,000 feet - Effect on heart rate response  
p 246 A90-39642
- High +Gz centrifuge training - The electrocardiographic response to +Gz-induced loss of consciousness  
p 246 A90-39643

## HELICOPTER PERFORMANCE

- Superimposed perspective visual cues for helicopter hovering above a moving ship deck  
p 254 A90-42455

## HELICOPTERS

- Target selection in anti-tank helicopter operations: Relative weight of cues in target evaluation judgements  
[FOA-C-50072-5.2] p 255 N90-23881
- Target selection in anti-tank operations: Effects of experience  
[FOA-C-50073-5.2] p 255 N90-23882
- Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire  
[FOA-C-50074-5.2] p 255 N90-23883

## HELMET MOUNTED DISPLAYS

- Low cost design alternatives for head mounted stereoscopic displays  
p 257 A90-38853
- Human factors and safety considerations of night vision systems flight  
p 258 A90-40380
- Helmet mounted displays - Evaluation of impact on the operator  
p 258 A90-40384
- Designing the virtual cockpit man-machine interface  
p 258 A90-40389

## HELMETS

- Evaluation of the head injury hazard during military parachuting  
[AD-A220724] p 248 N90-23870
- Field evaluation of laser protective eyewear  
[AD-A221324] p 263 N90-24725

## HEMATOPOIETIC SYSTEM

- The effects of simulated hypogravity on murine bone marrow cells  
p 251 N90-24989

## HERMES MANNED SPACEPLANE

- The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations  
p 261 N90-24296
- HERA and EVA co-operation scenarios  
p 261 N90-24299
- The Hermes robot arm teleoperation and control concept  
p 261 N90-24301
- HERA teleoperation test facility  
p 262 N90-24303

## HIGH ACCELERATION

- Rheoencephalography in simulated aviation environmental stress  
[AD-A221150] p 250 N90-24716

## HIGH ALTITUDE PRESSURE

- Effects of high altitude hypoxia on lung and chest wall function during exercise  
[AD-A219814] p 248 N90-23869

## HIGH GRAVITY ENVIRONMENTS

- Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels  
p 244 A90-41819

## HOMEOSTASIS

- Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity  
p 263 N90-24975

## HORMONE METABOLISMS

- Hormonal regulation of fluid and electrolytes during prolonged bed rest - Implications for microgravity  
p 247 A90-40750

## HOVERING

- Superimposed perspective visual cues for helicopter hovering above a moving ship deck  
p 254 A90-42455

## HUMAN BEINGS

- Brain stem evoked responses in altered G environments  
[AD-A220097] p 249 N90-23874

- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1  
[AD-A218614] p 250 N90-24713
- Rheoencephalography in simulated aviation environmental stress  
[AD-A221150] p 250 N90-24716
- HUMAN BODY**
- Noninvasive estimation of fluid shifts between body compartments by measurement of bioelectric characteristics p 251 N90-24976
- HUMAN CENTRIFUGES**
- Vestibulo-ocular responses in man to +Gz hypergravity p 246 A90-39645
- HUMAN FACTORS ENGINEERING**
- Human factors and safety considerations of night vision systems flight p 258 A90-40380
- A comparative analysis of work-hour forecasting techniques at the crew level  
[AD-A220706] p 260 N90-23894
- Telerobotic architecture for an on-orbit servicer p 262 N90-24302
- HERA teleoperation test facility p 262 N90-24303
- Teleoperation of a force controlled robot manipulator without force feedback to a human operator p 262 N90-24305
- A survey of human factors methodologies and models for improving the maintainability design of emerging Army aviation systems p 263 N90-24724
- [AD-A221159] p 263 N90-24724
- Knowledge-based control of an adaptive interface p 264 N90-24987
- HUMAN PERFORMANCE**
- Perceptual issues in scientific visualization p 252 A90-38858
- Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989 [SPIE-1077] p 252 A90-38864
- Receptive fields and visual representations p 252 A90-38865
- A new paradigm for testing human and machine motion perception p 252 A90-38868
- Unified model for human color perception and visual adaptation p 253 A90-38872
- Study of acute hypoxic effect on human performance under aerospace conditions p 246 A90-39321
- Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644
- Biophysical and clinical aspects of heliobiology: Collection of scientific works p 244 A90-41954
- Effect of extraneous color-coded targets on identification of targets on CRT displays  
[AD-A219473] p 254 N90-23879
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- Overtraining and exercise motivation: A research prospectus p 256 N90-24982
- Research in human performance related to space: A compilation of three projects/proposals p 264 N90-24983
- HUMAN TOLERANCES**
- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- HUMERUS**
- Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646
- HUMIDITY**
- Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity p 263 N90-24975
- HYGIENE**
- Identifying atmospheric monitoring needs for Space Station Freedom p 264 N90-24977
- HYOSCINE**
- Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644
- HYPERVENTILATION**
- Effects of high altitude hypoxia on lung and chest wall function during exercise  
[AD-A219814] p 248 N90-23869
- HYPOKINESIA**
- Effect of body suspension hypokinesia on skeletal muscle trained previously by endurance exercise p 244 A90-41820
- HYPOTHERMIA**
- Effects of cold and capsaicin desensitization on prostaglandin E hypothermia in rats p 243 A90-40075
- Field management of accidental hypothermia during diving  
[AD-A219560] p 247 N90-23866
- HYPOTHESES**
- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1  
[AD-A218614] p 250 N90-24713
- HYPOXIA**
- Study of acute hypoxic effect on human performance under aerospace conditions p 246 A90-39321
- Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642
- Oxidative phosphorylation system during steady-state hypoxia in the dog brain p 243 A90-40074
- Effects of high altitude hypoxia on lung and chest wall function during exercise  
[AD-A219814] p 248 N90-23869
- I**
- IDENTIFYING**
- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1  
[AD-A218614] p 250 N90-24713
- ILLUMINATING**
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- IMAGE PROCESSING**
- Psychophysical rating of image compression techniques p 252 A90-38866
- Neuromorphic optical signal processing and image understanding for automated target recognition  
[AD-A219827] p 255 N90-23884
- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1  
[AD-A218614] p 250 N90-24713
- IMMUNE SYSTEMS**
- Effects of spaceflight on levels and activity of immune cells p 243 A90-39647
- Reciprocal relationships between the immune and central nervous system  
[AD-A221259] p 245 N90-24712
- IMMUNITY**
- Reciprocal relationships between the immune and central nervous system  
[AD-A221259] p 245 N90-24712
- INDEXES (DOCUMENTATION)**
- Aerospace medicine and biology: A continuing bibliography with indexes (supplement 336)  
[NASA-SP-7011(336)] p 249 N90-23877
- INFLATABLE STRUCTURES**
- A preliminary design of interior structure and foundation of an inflatable lunar habitat p 264 N90-24999
- INFORMATION PROCESSING (BIOLOGY)**
- Electronic modulation of biomaterial functions p 244 A90-41265
- INJURIES**
- Evaluation of the head injury hazard during military parachuting  
[AD-A220724] p 248 N90-23870
- INSPECTION**
- Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333
- INTERFERON**
- Reciprocal relationships between the immune and central nervous system  
[AD-A221259] p 245 N90-24712
- INTOXICATION**
- Aviators intoxicated by inhalation of JP-5 fuel vapors p 247 A90-39648
- IODINE**
- Electrochemical control of iodine disinfectant for space transportation system and space station potable water p 264 N90-24981
- IRRADIATION**
- High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys  
[AD-A219570] p 245 N90-23863
- In vitro photoreactivation of transforming DNA of bacillus subtilis spores after irradiation with UV light  
[DLR-FB-89-45] p 245 N90-24710
- J**
- JET LAG**
- A laboratory study of the effects of diet and bright light countermeasures to jet lag  
[AD-A220148] p 249 N90-23875
- JOINTS (ANATOMY)**
- Decompression sickness affecting the temporomandibular joint  
[AD-A220959] p 250 N90-24715
- JOINTS (JUNCTIONS)**
- Real time inverse kinematics with joint limits and spatial constraints  
[AD-A220462] p 263 N90-24723
- JP-5 JET FUEL**
- Aviators intoxicated by inhalation of JP-5 fuel vapors p 247 A90-39648
- JUDGMENTS**
- Pilots' perception of risks and hazards in general aviation p 253 A90-39641
- Limits of fusion and depth judgment in stereoscopic color displays p 254 A90-42286
- Target selection in anti-tank helicopter operations: Relative weight of cues in target evaluation judgements  
[FOA-C-50072-5.2] p 255 N90-23881
- Target selection in anti-tank operations: Effects of experience  
[FOA-C-50073-5.2] p 255 N90-23882
- Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire  
[FOA-C-50074-5.2] p 255 N90-23883
- Hand shaping: A paradigm for cognitive/motoric interaction  
[AD-A219908] p 255 N90-23885
- K**
- KINEMATICS**
- Real time inverse kinematics with joint limits and spatial constraints  
[AD-A220462] p 263 N90-24723
- KNOWLEDGE BASES (ARTIFICIAL INTELLIGENCE)**
- Knowledge-based control of an adaptive interface p 264 N90-24987
- KRIGING**
- The application of kriging in the statistical analysis of anthropometric data, volume 1  
[AD-A220613] p 260 N90-23891
- The application of kriging in the statistical analysis of anthropometric data, volume 2  
[AD-A220614] p 260 N90-23892
- The application of kriging in the statistical analysis of anthropometric data, volume 3  
[AD-A220615] p 260 N90-23893
- L**
- LABOR**
- A comparative analysis of work-hour forecasting techniques at the crew level  
[AD-A220706] p 260 N90-23894
- LANDMARKS**
- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1  
[AD-A218614] p 250 N90-24713
- LASER BEAMS**
- Eye centered interferometric laser protection p 258 A90-40390
- A new approach to laser filters p 258 A90-40391
- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1  
[AD-A218614] p 250 N90-24713
- LASER DAMAGE**
- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- Dazzling glare: Protection criteria versus visual performance  
[AD-A219676] p 259 N90-23889
- Field evaluation of laser protective eyewear  
[AD-A221324] p 263 N90-24725
- LASER TARGETS**
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- LASER WEAPONS**
- Field evaluation of laser protective eyewear  
[AD-A221324] p 263 N90-24725
- LEARNING**
- DURIP: Computational modeling of cognitive processes  
[AD-A219934] p 255 N90-23886
- Analysis of neural systems involved in modulation of memory storage  
[AD-A220230] p 250 N90-24714
- LEARNING CURVES**
- A comparative analysis of work-hour forecasting techniques at the crew level  
[AD-A220706] p 260 N90-23894

**LESIONS**

- Dazzling glare: Protection criteria versus visual performance [AD-A219676] p 259 N90-23889

**LEUKOCYTES**

- Reciprocal relationships between the immune and central nervous system [AD-A221259] p 245 N90-24712

**LIFE SCIENCES**

- Strategic implementation plan [NASA-TM-102907] p 244 N90-23861

**LIFE SUPPORT SYSTEMS**

- Life support system - Dorniers contribution for space applications p 258 A90-41116
- Identifying atmospheric monitoring needs for Space Station Freedom p 264 N90-24977

**LIGHT (VISIBLE RADIATION)**

- A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875

**LIGHTING EQUIPMENT**

- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting [AD-A219456] p 259 N90-23888

**LOADS (FORCES)**

- Physiological and perceptual responses to prolonged treadmill load carriage [AD-A218809] p 247 N90-23865

**LOGISTICS**

- A survey of human factors methodologies and models for improving the maintainability design of emerging Army aviation systems [AD-A221159] p 263 N90-24724

**LOWER BODY NEGATIVE PRESSURE**

- Strategies to sustain and enhance performance in stressful environments [AD-A221224] p 245 N90-24711

**LUNAR SHELTERS**

- Lunar shelter [ILR-MITT-233(1989)] p 260 N90-23896

**LUNGS**

- Effects of high altitude hypoxia on lung and chest wall function during exercise [AD-A219814] p 248 N90-23869

**LYSOZYME**

- Preliminary crystallographic examination of a novel fungal lysozyme from Chalaropsis p 243 A90-40377

**M**

**MACROPHAGES**

- Reciprocal relationships between the immune and central nervous system [AD-A221259] p 245 N90-24712

**MAINTAINABILITY**

- A survey of human factors methodologies and models for improving the maintainability design of emerging Army aviation systems [AD-A221159] p 263 N90-24724

**MAINTENANCE**

- Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333

**MAN MACHINE SYSTEMS**

- Effects of biodynamic coupling on the human operator model p 258 A90-40161
- Designing the virtual cockpit man-machine interface p 258 A90-40389

**MAN TENDED FREE FLYERS**

- The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296

**MAN-COMPUTER INTERFACE**

- Telerobotic application to EVA p 261 N90-24298
- Telerobotic architecture for an on-orbit servicer p 262 N90-24302
- Knowledge-based control of an adaptive interface p 264 N90-24987

**MANIPULATORS**

- Stereo TV improves manipulator performance p 257 A90-38852
- HERA and EVA co-operation scenarios p 261 N90-24299
- HERA teleoperation test facility p 262 N90-24303
- A flexible teleoperation test bed for human factors experimentation p 262 N90-24304
- Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333

**MANNED SPACE FLIGHT**

- The European EVA spacesuit mechanisms p 263 N90-24481

**MANNED SPACECRAFT**

- Life support system - Dorniers contribution for space applications p 258 A90-41116

**MANPOWER**

- A survey of human factors methodologies and models for improving the maintainability design of emerging Army aviation systems [AD-A221159] p 263 N90-24724

**MANUAL CONTROL**

- Effects of biodynamic coupling on the human operator model p 258 A90-40161

**MASTICATION**

- Decompression sickness affecting the temporomandibular joint [AD-A220959] p 250 N90-24715

**MATHEMATICAL MODELS**

- Model for predicting the effects of laser exposures and eye protection on vision [AD-A219697] p 248 N90-23868
- DURIP: Computational modeling of cognitive processes [AD-A219934] p 255 N90-23886
- From where they look to what they think: Determining controller cognitive strategies from oculometer scanning data p 256 N90-25041

**MEMBRANE STRUCTURES**

- A preliminary design of interior structure and foundation of an inflatable lunar habitat p 264 N90-24999

**MEMORY**

- Analysis of neural systems involved in modulation of memory storage [AD-A220230] p 250 N90-24714

**MENTAL PERFORMANCE**

- Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644
- An empirically derived figure of merit for the quality of overall task performance p 265 N90-25058

**METAL IONS**

- Biosensors for the detection of heavy metal ions [MBB-Z-0289-89-PUB] p 245 N90-23864

**METALS**

- The biogeochemistry of metal cycling [NASA-CR-4295] p 265 N90-23897

**MICE**

- The effects of simulated hypogravity on murine bone marrow cells p 251 N90-24899

**MICROBIOLOGY**

- The biogeochemistry of metal cycling [NASA-CR-4295] p 265 N90-23897

**MICROCOMPUTERS**

- Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644

**MICROWAVES**

- High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

**MIDAIR COLLISIONS**

- Effects of monitoring under high and low taskload on detection of flashing and colored radar targets [AD-A220313] p 260 N90-23895

**MILITARY AIRCRAFT**

- Human factors and safety considerations of night vision systems flight p 258 A90-40380

**MILITARY OPERATIONS**

- Evaluation of the head injury hazard during military parachuting [AD-A220724] p 248 N90-23870

**MILITARY TECHNOLOGY**

- Auditory perception of complex sounds [AD-A219927] p 249 N90-23872

**MODULATION**

- Analysis of neural systems involved in modulation of memory storage [AD-A220230] p 250 N90-24714

**MOLECULAR BIOLOGY**

- Electronic modulation of biomaterial functions p 244 A90-41265

**MONITORS**

- DURIP: Improved eye movement monitoring capabilities for studies in visual cognition [AD-A220355] p 263 N90-24722

**MONKEYS**

- High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

**MOON**

- A preliminary design of interior structure and foundation of an inflatable lunar habitat p 264 N90-24999

**MOTION PERCEPTION**

- A new paradigm for testing human and machine motion perception p 252 A90-38868
- Motion perception model with interactions between spatial frequency channels p 253 A90-38869
- Cortical microstimulation influences perceptual judgements of motion direction p 244 A90-41874

**MOTION SICKNESS**

- Brain stem evoked responses in altered G environments [AD-A220097] p 249 N90-23874

**MOTION SICKNESS DRUGS**

- Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644

**MOTION SIMULATION**

- Analysis of the accuracy of a proposed target motion analysis procedure [AD-A219481] p 254 N90-23880

**MULTIVARIATE STATISTICAL ANALYSIS**

- The application of kriging in the statistical analysis of anthropometric data, volume 1 [AD-A220613] p 260 N90-23891
- The application of kriging in the statistical analysis of anthropometric data, volume 2 [AD-A220614] p 260 N90-23892
- The application of kriging in the statistical analysis of anthropometric data, volume 3 [AD-A220615] p 260 N90-23893

**MUSCLES**

- Research in human performance related to space: A compilation of three projects/proposals p 264 N90-24983

**MUSCULAR FATIGUE**

- Effects of high altitude hypoxia on lung and chest wall function during exercise [AD-A219814] p 248 N90-23869

**MUSCULOSKELETAL SYSTEM**

- Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels p 244 A90-41819
- Effect of body suspension hypokinesia on skeletal muscle trained previously by endurance exercise p 244 A90-41820
- Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity p 251 N90-24993

**N**

**NERVES**

- Perception of complex auditory patterns [AD-A219626] p 248 N90-23867

**NEURAL NETS**

- DURIP-Instrumentation for recording and analyzing multiple input/output saccadic eye movement neurosensory control [AD-A219905] p 248 N90-23871
- Neuromorphic optical signal processing and image understanding for automated target recognition [AD-A219827] p 255 N90-23884

**NEUROLOGY**

- Neurotransmitter and peptide localization in human brain [AD-A219964] p 249 N90-23873
- Decompression sickness affecting the temporomandibular joint [AD-A220959] p 250 N90-24715

**NEUROMUSCULAR TRANSMISSION**

- Neurotransmitter and peptide localization in human brain [AD-A219964] p 249 N90-23873

**NEUROPHYSIOLOGY**

- DURIP-Instrumentation for recording and analyzing multiple input/output saccadic eye movement neurosensory control [AD-A219905] p 248 N90-23871
- Analysis of neural systems involved in modulation of memory storage [AD-A220230] p 250 N90-24714

**NEUROTRANSMITTERS**

- Neurotransmitter and peptide localization in human brain [AD-A219964] p 249 N90-23873

**NEUTRAL BUOYANCY SIMULATION**

- Telerobotic application to EVA p 261 N90-24298

**NIGHT VISION**

- Human factors and safety considerations of night vision systems flight p 258 A90-40380
- The application of kriging in the statistical analysis of anthropometric data, volume 1 [AD-A220613] p 260 N90-23891
- The application of kriging in the statistical analysis of anthropometric data, volume 3 [AD-A220615] p 260 N90-23893

**NOISE (SOUND)**

- Auditory perception of complex sounds [AD-A219927] p 249 N90-23872

**NOISE INTENSITY**

- Analyses of the predictability of noise-induced sleep disturbance [AD-A220156] p 249 N90-23876



## NUTRITION

Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646

## O

## OCULOGRAPHIC ILLUSIONS

Vestibulo-ocular responses in man to +Gz hypergravity p 246 A90-39645

## OCULOMETERS

From where they look to what they think: Determining controller cognitive strategies from oculometer scanning data p 256 N90-25041

## OCULOMOTOR NERVES

The role of ocular muscle proprioception in visual localization of targets p 253 A90-40278

## ON-LINE SYSTEMS

On-line estimation of human operator workload p 258 A90-40839

## OPERATOR PERFORMANCE

Stereo TV improves manipulator performance p 257 A90-38852

Effects of biodynamic coupling on the human operator model p 258 A90-40161

On-line estimation of human operator workload p 258 A90-40839

Mental lapses and event-related potentials [AD-A219454] p 254 N90-23878

## OPTICAL FIBERS

A new approach to laser filters p 258 A90-40391

## OPTICAL FILTERS

Eye centered interferometric laser protection p 258 A90-40390

A new approach to laser filters p 258 A90-40391

## OPTICAL TRACKING

DURIP: Improved eye movement monitoring capabilities for studies in visual cognition [AD-A220355] p 263 N90-24722

## OPTIMIZATION

Neuromorphic optical signal processing and image understanding for automated target recognition [AD-A219827] p 255 N90-23884

## ORBITAL SERVICING

The European EVA suit: An optimized tool for Hermes/MTF in-orbit operations p 261 N90-24296

Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297

HERA and EVA co-operation scenarios p 261 N90-24299

Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300

Telerobotic architecture for an on-orbit servicer p 262 N90-24302

A flexible teleoperation test bed for human factors experimentation p 262 N90-24304

The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307

## ORGANIZATIONS

A systematic approach to training: A training needs assessment p 257 N90-25059

## ORTHOSTATIC TOLERANCE

Effect of fluid countermeasures of varying osmolarity on cardiovascular responses to orthostatic stress p 251 N90-24978

## OSTEOPOROSIS

Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity p 251 N90-24993

## OXYGEN BREATHING

Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642

Effects of high altitude hypoxia on lung and chest wall function during exercise [AD-A219814] p 248 N90-23869

## P

## PARACHUTE DESCENT

Evaluation of the head injury hazard during military parachuting [AD-A220724] p 248 N90-23870

## PARAMASAL SINUSES

Recurrent sinusitis and impairment of eustachian tube function in air passengers and crew p 247 A90-39649

## PASSENGERS

Recurrent sinusitis and impairment of eustachian tube function in air passengers and crew p 247 A90-39649

## PATHOLOGICAL EFFECTS

Field management of accidental hypothermia during diving [AD-A219560] p 247 N90-23866

## PATTERN RECOGNITION

Neuromorphic optical signal processing and image understanding for automated target recognition [AD-A219827] p 255 N90-23884

## PERCEPTUAL ERRORS

Perceptual issues in scientific visualization p 252 A90-38858

## PERSONALITY TESTS

Pilots' perception of risks and hazards in general aviation p 253 A90-39641

## PERSONNEL MANAGEMENT

A systematic approach to training: A training needs assessment p 257 N90-25059

## PERSONNEL SELECTION

The incremental validity of spatial and perceptual-psychomotor tests relative to the armed services vocational aptitude battery [AD-A220903] p 256 N90-24719

Activities report of the National Aerospace Medical Center [ETN-90-96936] p 256 N90-24721

## PHOSPHORYLATION

Oxidative phosphorylation system during steady-state hypoxia in the dog brain p 243 A90-40074

## PHOTOCHEMICAL REACTIONS

In vitro photoreactivation of transforming DNA of bacillus subtilis spores after irradiation with UV light [DLR-FB-89-45] p 245 N90-24710

## PHOTOSYNTHESIS

Model of carbon fixation in microbial mats from 3,500 Myr ago to the present p 243 A90-39821

## PHYSICAL EXAMINATIONS

Decompression sickness affecting the temporomandibular joint [AD-A220959] p 250 N90-24715

Activities report of the National Aerospace Medical Center [ETN-90-96936] p 256 N90-24721

## PHYSICAL EXERCISE

Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys [AD-A219455] p 244 N90-23862

Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity p 263 N90-24975

Overtraining and exercise motivation: A research prospectus p 256 N90-24982

The use of underwater dynamometry to evaluate two space suits p 264 N90-24995

## PHYSICAL FITNESS

Effects of high altitude hypoxia on lung and chest wall function during exercise [AD-A219814] p 248 N90-23869

## PHYSIOLOGICAL DEFENSES

Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology [AD-A221222] p 250 N90-24717

## PHYSIOLOGICAL EFFECTS

Physiological and perceptual responses to prolonged treadmill load carriage [AD-A218809] p 247 N90-23865

Strategies to sustain and enhance performance in stressful environments [AD-A221224] p 245 N90-24711

Research in human performance related to space: A compilation of three projects/proposals p 264 N90-24983

## PHYSIOLOGICAL RESPONSES

Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642

Vestibulo-ocular responses in man to +Gz hypergravity p 246 A90-39645

Effects of spaceflight on levels and activity of immune cells p 243 A90-39647

Physiological and perceptual responses to prolonged treadmill load carriage [AD-A218809] p 247 N90-23865

Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting [AD-A219456] p 259 N90-23888

Effect of fluid countermeasures of varying osmolarity on cardiovascular responses to orthostatic stress p 251 N90-24978

## PHYSIOLOGY

Research in human performance related to space: A compilation of three projects/proposals p 264 N90-24983

## PILOT PERFORMANCE

Helmet mounted displays - Evaluation of impact on the operator p 258 A90-40384

Target selection in anti-tank helicopter operations:

Relative weight of cues in target evaluation judgements [FOA-C-50072-5.2] p 255 N90-23881

Target selection in anti-tank operations: Effects of experience [FOA-C-50073-5.2] p 255 N90-23882

Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire [FOA-C-50074-5.2] p 255 N90-23883

Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology [AD-A221222] p 250 N90-24717

Activities report of the National Aerospace Medical Center [ETN-90-96936] p 256 N90-24721

An empirically derived figure of merit for the quality of overall task performance p 265 N90-25058

## PILOT TRAINING

Pilot decision-making training [AD-A221349] p 256 N90-24720

## PLANNING

Understanding our genetic inheritance. The US Human genome project: The first five years, FY 1991-1995 [DE90-008240] p 250 N90-24718

## POPULATIONS

The effects of simulated hypogravity on murine bone marrow cells p 251 N90-24989

## POSTURE

Relationships between orientation, movement and posture in weightlessness - Preliminary ethological observations p 246 A90-38929

## POTABLE WATER

Electrochemical control of iodine disinfectant for space transportation system and space station potable water p 264 N90-24981

## POTASSIUM

Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity p 251 N90-24993

## PREDICTION ANALYSIS TECHNIQUES

Adding a dimension: Time as a factor in the generalizability of predictive relationships [AD-A219679] p 259 N90-23890

## PREDICTIONS

Analyses of the predictability of noise-induced sleep disturbance [AD-A220156] p 249 N90-23876

## PRESENTATION

Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire [FOA-C-50074-5.2] p 255 N90-23883

## PRESSURE BREATHING

Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642

## PROPRIOCEPTION

The role of ocular muscle proprioception in visual localization of targets p 253 A90-40278

## PROSTAGLANDINS

Effects of cold and capsaicin desensitization on prostaglandin E hypothermia in rats p 243 A90-40075

## PSYCHOLOGICAL EFFECTS

Strategies to sustain and enhance performance in stressful environments [AD-A221224] p 245 N90-24711

## PSYCHOLOGICAL FACTORS

Hand shaping: A paradigm for cognitive/motoric interaction [AD-A219908] p 255 N90-23885

## PSYCHOLOGICAL TESTS

Biological and cognitive determination of the gravitational reference frame p 253 A90-38928

The incremental validity of spatial and perceptual-psychomotor tests relative to the armed services vocational aptitude battery [AD-A220903] p 256 N90-24719

Activities report of the National Aerospace Medical Center [ETN-90-96936] p 256 N90-24721

## PSYCHOMOTOR PERFORMANCE

High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

The incremental validity of spatial and perceptual-psychomotor tests relative to the armed services vocational aptitude battery [AD-A220903] p 256 N90-24719

## PSYCHOPHYSICS

Psychophysical rating of image compression techniques p 252 A90-38966

## PSYCHOPHYSIOLOGY

Mental lapses and event-related potentials [AD-A219454] p 254 N90-23878

## PUPIL SIZE

Optical factors in judgments of size through an aperture p 254 A90-42289

## PURSUIT TRACKING

DURIP: Improved eye movement monitoring capabilities for studies in visual cognition [AD-A220355] p 263 N90-24722

## PYRIDINES

Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology [AD-A221222] p 250 N90-24717

## R

## RADAR DETECTION

Effects of monitoring under high and low taskload on detection of flashing and colored radar targets [AD-A220313] p 260 N90-23895

## RADAR TARGETS

Neuromorphic optical signal processing and image understanding for automated target recognition [AD-A219827] p 255 N90-23884

Effects of monitoring under high and low taskload on detection of flashing and colored radar targets [AD-A220313] p 260 N90-23895

## RADIATION EFFECTS

High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

## RADIATION HAZARDS

High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

## RADIATION PROTECTION

Eye centered interferometric laser protection p 258 A90-40390

## REACTION TIME

Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys [AD-A219455] p 244 N90-23862

## REAL TIME OPERATION

Real time inverse kinematics with joint limits and spatial constraints [AD-A220462] p 263 N90-24723

## RECYCLING

Electrochemical control of iodine disinfectant for space transportation system and space station potable water p 264 N90-24981

## REDUCED GRAVITY

Hormonal regulation of fluid and electrolytes during prolonged bed rest - Implications for microgravity p 247 A90-40750

The effects of simulated hypogravity on murine bone marrow cells p 251 N90-24989

Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity p 251 N90-24993

## REMOTE CONTROL

A flexible teleoperation test bed for human factors experimentation p 262 N90-24304

## REMOTE MANIPULATOR SYSTEM

The Hermes robot arm teleoperation and control concept p 261 N90-24301

Teleoperation of a force controlled robot manipulator without force feedback to a human operator p 262 N90-24305

The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307

The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307

## REMOTE SENSING

The biogeochemistry of metal cycling [NASA-CR-4295] p 265 N90-23897

## RESCUE OPERATIONS

A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

## RESEARCH MANAGEMENT

Strategic implementation plan [NASA-TM-102907] p 244 N90-23861

## RESPIRATION

Aviators intoxicated by inhalation of JP-5 fuel vapors p 247 A90-39648

## RESPONSES

Effect of extraneous color-coded targets on identification of targets on CRT displays [AD-A219473] p 254 N90-23879

## RETINAL IMAGES

Alternative representations of visual space p 252 A90-38861

Optical factors in judgments of size through an aperture p 254 A90-42289

## RHEOENCEPHALOGRAPHY

Rheoencephalography in simulated aviation environmental stress [AD-A221150] p 250 N90-24716

## RHYTHM (BIOLOGY)

A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875

## RISK

Pilots' perception of risks and hazards in general aviation p 253 A90-39641

Pilot decision-making training [AD-A220149] p 256 N90-24720

## ROBOT ARMS

HERA and EVA co-operation scenarios p 261 N90-24299

The Hermes robot arm teleoperation and control concept p 261 N90-24301

HERA teleoperation test facility p 262 N90-24303

The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307

## ROBOTICS

Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297

Telerobotic application to EVA p 261 N90-24298

Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300

A flexible teleoperation test bed for human factors experimentation p 262 N90-24304

## ROBOTS

A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

Telerobotic application to EVA p 261 N90-24298

## S

## SACCADIC EYE MOVEMENTS

DURIP-Instrumentation for recording and analyzing multiple input/output saccadic eye movement neurosensory control [AD-A219905] p 248 N90-23871

## SEQUENCING

An empirically derived figure of merit for the quality of overall task performance p 265 N90-25058

## SHAPES

Hand shaping: A paradigm for cognitive/motoric interaction [AD-A219908] p 255 N90-23885

## SIGNAL DETECTION

Mental lapses and event-related potentials [AD-A219454] p 254 N90-23878

## SIGNAL PROCESSING

Neuromorphic optical signal processing and image understanding for automated target recognition [AD-A219827] p 255 N90-23884

## SIGNS AND SYMPTOMS

A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875

## SIZE SEPARATION

Optical factors in judgments of size through an aperture p 254 A90-42289

## SLEEP DEPRIVATION

Analyses of the predictability of noise-induced sleep disturbance [AD-A220156] p 249 N90-23876

## SODIUM

Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity p 251 N90-24993

## SOLAR ACTIVITY EFFECTS

Biophysical and clinical aspects of heliobiology: Collection of scientific works p 244 A90-41954

## SOLAR TERRESTRIAL INTERACTIONS

Biophysical and clinical aspects of heliobiology: Collection of scientific works p 244 A90-41954

## SONAR

Effect of extraneous color-coded targets on identification of targets on CRT displays [AD-A219473] p 254 N90-23879

## SPACE FLIGHT

Effects of spaceflight on levels and activity of immune cells p 243 A90-39647

## SPACE FLIGHT STRESS

Research in human performance related to space: A compilation of three projects/proposals p 264 N90-24983

## SPACE LOGISTICS

Lunar shelter [ILR-MITT-233(1989)] p 260 N90-23896

## SPACE MAINTENANCE

The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296

## SPACE ORIENTATION

Relationships between orientation, movement and posture in weightlessness - Preliminary ethological observations p 246 A90-38929

## SPACE PERCEPTION

Limits of fusion and depth judgment in stereoscopic color displays p 254 A90-42286

The incremental validity of spatial and perceptual-psychomotor tests relative to the armed services vocational aptitude battery [AD-A220903] p 256 N90-24719

## SPACE PSYCHOLOGY

Biological and cognitive determination of the gravitational reference frame p 253 A90-38928

## SPACE RENDEZVOUS

A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

## SPACE STATION PAYLOADS

Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297

## SPACE STATIONS

Application of visual psychophysics to the design of video systems for use in space p 257 A90-38870

Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity p 263 N90-24975

Identifying atmospheric monitoring needs for Space Station Freedom p 264 N90-24977

Electrochemical control of iodine disinfectant for space transportation system and space station potable water p 264 N90-24981

Knowledge-based control of an adaptive interface p 264 N90-24987

## SPACE SUITS

The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296

The European EVA spacesuit mechanisms p 263 N90-24481

The use of underwater dynamometry to evaluate two space suits p 264 N90-24995

## SPACE TRANSPORTATION SYSTEM

Electrochemical control of iodine disinfectant for space transportation system and space station potable water p 264 N90-24981

The use of underwater dynamometry to evaluate two space suits p 264 N90-24995

## SPACECRAFT MAINTENANCE

HERA and EVA co-operation scenarios p 261 N90-24299

Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300

Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300

## SPACECREWS

Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297

Effect of fluid countermeasures of varying osmolality on cardiovascular responses to orthostatic stress p 251 N90-24978

Overtraining and exercise motivation: A research prospectus p 256 N90-24982

## SPATIAL FILTERING

Motion perception model with interactions between spatial frequency channels p 253 A90-38869

## SPATIAL RESOLUTION

Proximity compatibility and information display - Effects of color, space, and objectness on information integration p 254 A90-42287

## SPEECH

DURIP: Computational modeling of cognitive processes [AD-A219934] p 255 N90-23886

## SPEECH RECOGNITION

Perception of complex auditory patterns [AD-A219626] p 248 N90-23867

## SPEED INDICATORS

Proximity compatibility and information display - Effects of color, space, and objectness on information integration p 254 A90-42287

## SPHERES

A preliminary design of interior structure and foundation of an inflatable lunar habitat p 264 N90-24999

## SPHERICAL SHELLS

A preliminary design of interior structure and foundation of an inflatable lunar habitat p 264 N90-24999

## SPORES

In vitro photoreactivation of transforming DNA of bacillus subtilis spores after irradiation with UV light [DLR-FB-89-45] p 245 N90-24710

## STANDARD DEVIATION

An empirically derived figure of merit for the quality of overall task performance p 265 N90-25058

**STANDARDS**

- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868
- Dazzling glare: Protection criteria versus visual performance  
[AD-A219676] p 259 N90-23889

**STATISTICAL ANALYSIS**

- The application of kriging in the statistical analysis of anthropometric data, volume 1  
[AD-A220613] p 260 N90-23891
- The application of kriging in the statistical analysis of anthropometric data, volume 2  
[AD-A220614] p 260 N90-23892

**STEREOSCOPIC VISION**

- Low cost design alternatives for head mounted stereoscopic displays p 257 A90-38853
- Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333

**STEREOTELEVISION**

- Stereo TV improves manipulator performance p 257 A90-38852

**STRATEGY**

- From where they look to what they think: Determining controller cognitive strategies from oculometer scanning data p 256 N90-25041

**STRESS (PHYSIOLOGY)**

- Strategies to sustain and enhance performance in stressful environments  
[AD-A221224] p 245 N90-24711

**STRUCTURAL ANALYSIS**

- Understanding our genetic inheritance. The US Human genome project: The first five years, FY 1991-1995  
[DE90-008240] p 250 N90-24718

**STRUCTURAL DESIGN**

- A preliminary design of interior structure and foundation of an inflatable lunar habitat p 264 N90-24999

**STRUCTURAL WEIGHT**

- A preliminary design of interior structure and foundation of an inflatable lunar habitat p 264 N90-24999

**SULFATES**

- Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862

**SURVEYS**

- A systematic approach to training: A training needs assessment p 257 N90-25059

**SURVIVAL**

- Lunar shelter  
[ILR-MITT-233(1989)] p 260 N90-23896

**SYMPATHETIC NERVOUS SYSTEM**

- Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862

**SYNCHRONISM**

- Hand shaping: A paradigm for cognitive/motoric interaction  
[AD-A219908] p 255 N90-23885

**SYSTEMS ANALYSIS**

- A survey of human factors methodologies and models for improving the maintainability design of emerging Army aviation systems  
[AD-A221159] p 263 N90-24724

**T****TACHYCARDIA**

- High + Gz centrifuge training - The electrocardiographic response to + Gz-induced loss of consciousness p 246 A90-39643

**TARGET ACQUISITION**

- The role of ocular muscle proprioception in visual localization of targets p 253 A90-40278
- Target selection in anti-tank helicopter operations: Relative weight of cues in target evaluation judgements  
[FOA-C-50072-5.2] p 255 N90-23881
- Target selection in anti-tank operations: Effects of experience  
[FOA-C-50073-5.2] p 255 N90-23882
- Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire  
[FOA-C-50074-5.2] p 255 N90-23883

**TARGET RECOGNITION**

- Mental lapses and event-related potentials  
[AD-A219454] p 254 N90-23878
- Effect of extraneous color-coded targets on identification of targets on CRT displays  
[AD-A219473] p 254 N90-23879
- Analysis of the accuracy of a proposed target motion analysis procedure  
[AD-A219481] p 254 N90-23880

- Neuromorphic optical signal processing and image understanding for automated target recognition  
[AD-A219827] p 255 N90-23884

**TARGETS**

- Analysis of the accuracy of a proposed target motion analysis procedure  
[AD-A219481] p 254 N90-23880

**TASKS**

- Adding a dimension: Time as a factor in the generalizability of predictive relationships  
[AD-A219679] p 259 N90-23890
- From where they look to what they think: Determining controller cognitive strategies from oculometer scanning data p 256 N90-25041
- An empirically derived figure of merit for the quality of overall task performance p 265 N90-25058

**TELEOPERATORS**

- Telerobotic application to EVA p 261 N90-24298
- Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300
- Telerobotic architecture for an on-orbit servicer p 262 N90-24302
- HERA teleoperation test facility p 262 N90-24303
- A flexible teleoperation test bed for human factors experimentation p 262 N90-24304
- Teleoperation of a force controlled robot manipulator without force feedback to a human operator p 262 N90-24305
- The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307
- Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333

**TELEVISION SYSTEMS**

- Application of visual psychophysics to the design of video systems for use in space p 257 A90-38870

**TEST FACILITIES**

- HERA teleoperation test facility p 262 N90-24303
- A flexible teleoperation test bed for human factors experimentation p 262 N90-24304

**TEST PILOTS**

- Voice measures of workload in the advanced flight deck: Additional studies  
[NASA-CR-4258] p 259 N90-23887

**THERAPY**

- A laboratory study of the effects of diet and bright light countermeasures to jet lag  
[AD-A220148] p 249 N90-23875

**THERMAL COMFORT**

- Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity p 263 N90-24975

**THERMAL PROTECTION**

- Field management of accidental hypothermia during diving  
[AD-A219560] p 247 N90-23866

**THERMOREGULATION**

- Effects of cold and capsaicin desensitization on prostaglandin E hypothermia in rats p 243 A90-40075
- Field management of accidental hypothermia during diving  
[AD-A219560] p 247 N90-23866

**THREAT EVALUATION**

- Target selection in anti-tank helicopter operations: Relative weight of cues in target evaluation judgements  
[FOA-C-50072-5.2] p 255 N90-23881
- Target selection in anti-tank operations: Effects of experience  
[FOA-C-50073-5.2] p 255 N90-23882
- Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire  
[FOA-C-50074-5.2] p 255 N90-23883

**TIME**

- Adding a dimension: Time as a factor in the generalizability of predictive relationships  
[AD-A219679] p 259 N90-23890

**TIME MEASUREMENT**

- An empirically derived figure of merit for the quality of overall task performance p 265 N90-25058

**TOLERANCES (PHYSIOLOGY)**

- Dazzling glare: Protection criteria versus visual performance  
[AD-A219676] p 259 N90-23889

**TOXIC HAZARDS**

- Aviators intoxicated by inhalation of JP-5 fuel vapors p 247 A90-39648

**TRAINING ANALYSIS**

- A systematic approach to training: A training needs assessment p 257 N90-25059

**TRAINING SIMULATORS**

- Pilot decision-making training  
[AD-A221349] p 256 N90-24720

**TREADMILLS**

- Physiological and perceptual responses to prolonged treadmill load carriage  
[AD-A218809] p 247 N90-23865

**TREND ANALYSIS**

- The application of kriging in the statistical analysis of anthropometric data, volume 2  
[AD-A220614] p 260 N90-23892

**TUMORS**

- Reciprocal relationships between the immune and central nervous system  
[AD-A221259] p 245 N90-24712

**TYROSINE**

- Strategies to sustain and enhance performance in stressful environments  
[AD-A221224] p 245 N90-24711

**U****ULTRAVIOLET RADIATION**

- In vitro photoreactivation of transforming DNA of bacillus subtilis spores after irradiation with UV light  
[DLR-FB-89-45] p 245 N90-24710

**UNCONSCIOUSNESS**

- High + Gz centrifuge training - The electrocardiographic response to + Gz-induced loss of consciousness p 246 A90-39643

**V****VAPORS**

- Aviators intoxicated by inhalation of JP-5 fuel vapors p 247 A90-39648

**VASOCONSTRICTION**

- Field management of accidental hypothermia during diving  
[AD-A219560] p 247 N90-23866

**VECTOR ANALYSIS**

- DURIP: Improved eye movement monitoring capabilities for studies in visual cognition  
[AD-A220355] p 263 N90-24722

**VERTEBRAE**

- Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646

**VESTIBULAR NYSTAGMUS**

- Vestibulo-ocular responses in man to +Gz hypergravity p 246 A90-39645

**VESTIBULAR TESTS**

- Brain stem evoked responses in altered G environments  
[AD-A220097] p 249 N90-23874

**VESTIBULES**

- Brain stem evoked responses in altered G environments  
[AD-A220097] p 249 N90-23874

**VIDEO EQUIPMENT**

- Application of visual psychophysics to the design of video systems for use in space p 257 A90-38870

**VISION**

- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868
- DURIP: Improved eye movement monitoring capabilities for studies in visual cognition  
[AD-A220355] p 263 N90-24722

**VISUAL ACCOMMODATION**

- Unified model for human color perception and visual adaptation p 253 A90-38872

**VISUAL ACUITY**

- Human factors and safety considerations of night vision systems flight p 258 A90-40380

**VISUAL DISCRIMINATION**

- Eleven colors that are almost never confused p 253 A90-38871
- Critical color differences determined with a visual search task p 253 A90-40264
- Limits of fusion and depth judgment in stereoscopic color displays p 254 A90-42286
- Optical factors in judgments of size through an aperture p 254 A90-42289

**VISUAL FIELDS**

- Alternative representations of visual space p 252 A90-38861
- Receptive fields and visual representations p 252 A90-38865
- Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 254 A90-42455

**VISUAL OBSERVATION**

- Visions of visualization aids - Design philosophy and observations p 257 A90-38859
- Scientific work environments in the next decade p 257 A90-38860

Application of visual psychophysics to the design of video systems for use in space p 257 A90-38870

**VISUAL PERCEPTION**

Perceptual issues in scientific visualization p 252 A90-38858

Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989

[SPIE-1077] p 252 A90-38864  
Receptive fields and visual representations

Psychophysical rating of image compression techniques p 252 A90-38866

Motion perception model with interactions between spatial frequency channels p 253 A90-38869

Helmet mounted displays - Evaluation of impact on the operator p 258 A90-40384

Cortical microstimulation influences perceptual judgements of motion direction p 244 A90-41874

**VISUAL STIMULI**  
Cortical microstimulation influences perceptual judgements of motion direction p 244 A90-41874

**VISUAL TASKS**  
Critical color differences determined with a visual search task p 253 A90-40264

The role of ocular muscle proprioception in visual localization of targets p 253 A90-40278

**VOICE**  
Voice measures of workload in the advanced flight deck: Additional studies

[NASA-CR-4258] p 259 N90-23887

**VOICE CONTROL**  
A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

**W**

**WALKING**  
Physiological and perceptual responses to prolonged treadmill load carriage

[AD-A218809] p 247 N90-23865

**WATER**  
Effect of fluid countermeasures of varying osmolarity on cardiovascular responses to orthostatic stress

p 251 N90-24978

Electrochemical control of iodine disinfectant for space transportation system and space station potable water

p 264 N90-24981

**WEIGHTLESSNESS**  
Relationships between orientation, movement and posture in weightlessness - Preliminary ethological observations

p 246 A90-38929

Research in human performance related to space: A compilation of three projects/proposals

p 264 N90-24983

The effects of simulated hypogravity on murine bone marrow cells p 251 N90-24989

**WEIGHTLESSNESS SIMULATION**  
Noninvasive estimation of fluid shifts between body compartments by measurement of bioelectric characteristics

p 251 N90-24976

**WORK CAPACITY**  
Overtraining and exercise motivation: A research prospectus

p 256 N90-24982

**WORKLOADS (PSYCHOPHYSIOLOGY)**  
On-line estimation of human operator workload

p 258 A90-40839

Voice measures of workload in the advanced flight deck: Additional studies

[NASA-CR-4258] p 259 N90-23887

Effects of monitoring under high and low taskload on detection of flashing and colored radar targets

[AD-A220313] p 260 N90-23895

An empirically derived figure of merit for the quality of overall task performance p 265 N90-25058

**WORKSTATIONS**  
Scientific work environments in the next decade

p 257 A90-38860

Knowledge-based control of an adaptive interface

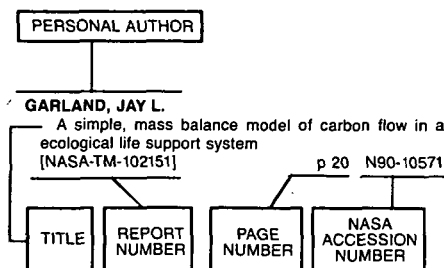
p 264 N90-24987

# PERSONAL AUTHOR INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 341)

October 1990

## Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

## A

- AIZAWA, MASUO**  
Electronic modulation of biomaterial functions  
p 244 A90-41265
- ALBERTINI, GUIDO**  
The European EVA spacesuit mechanisms  
p 263 N90-24481
- ALPERT, MURRAY**  
Voice measures of workload in the advanced flight deck: Additional studies  
[NASA-CR-4258] p 259 N90-23887
- ANDERSON, DAVID E.**  
Telerobotic application to EVA p 261 N90-24298
- ANDRE, ANTHONY D.**  
Proximity compatibility and information display - Effects of color, space, and objectness on information integration p 254 A90-42287
- ANDRE, G.**  
The Hermes robot arm teleoperation and control concept p 261 N90-24301  
The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307
- ANGELOGIANNI, PANAGOULA**  
Effects of cold and capsaicin desensitization on prostaglandin E hypothermia in rats p 243 A90-40075
- ARDITI, ARIES**  
Alternative representations of visual space p 252 A90-38861

## B

- BADLER, NORMAN I.**  
Real time inverse kinematics with joint limits and spatial constraints  
[AD-A220462] p 263 N90-24723
- BALL, JOHN F.**  
Effects of pyridostigmine bromide on in-flight aircrew performance p 247 A90-42288
- BALTZLEY, DENNIS R.**  
Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644

- BARBER, DAVID S.**  
Analyses of the predictability of noise-induced sleep disturbance  
[AD-A220156] p 249 N90-23876
- BARRACO, IGNAZIO**  
Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297
- BAUER, D. H.**  
Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642
- BERGER, G.**  
The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307
- BERRY, WALLACE D.**  
Effects of spaceflight on levels and activity of immune cells p 243 A90-39647
- BEUMER, RONALD J.**  
Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity p 263 N90-24975
- BINDER, F.**  
Biosensors for the detection of heavy metal ions  
[MBB-Z-0289-89-PUB] p 245 N90-23864
- BISHOP, PHILLIP A.**  
Noninvasive estimation of fluid shifts between body compartments by measurement of bioelectric characteristics p 251 N90-24976
- BIVENOUR, ROBYN**  
Effect of extraneous color-coded targets on identification of targets on CRT displays  
[AD-A219473] p 254 N90-23879
- BOMAR, J. B., JR.**  
Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642
- BOURDON-HENRY, V.**  
HERA teleoperation test facility p 262 N90-24303
- BOYNTON, ROBERT M.**  
Eleven colors that are almost never confused p 253 A90-38871
- BRITTEN, KENNETH H.**  
Cortical microstimulation influences perceptual judgements of motion direction p 244 A90-41874
- BROOKS, REBECCA B.**  
Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology  
[AD-A221222] p 250 N90-24717
- BROWN, JOHN A.**  
A new approach to laser filters p 258 A90-40391
- BUSCIGLIO, HENRY H.**  
The incremental validity of spatial and perceptual-psychomotor tests relative to the armed services vocational aptitude battery  
[AD-A220903] p 256 N90-24719
- BUTLER, S.**  
Oxidative phosphorylation system during steady-state hypoxia in the dog brain p 243 A90-40074

## C

- CARDANO, MARIO**  
Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297
- CARLSTROEM, ANDERS**  
Target selection in anti-tank helicopter operations: Relative weight of cues in target evaluation judgements  
[FOA-C-50072-5.2] p 255 N90-23881  
Target selection in anti-tank operations: Effects of experience  
[FOA-C-50073-5.2] p 255 N90-23882  
Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire  
[FOA-C-50074-5.2] p 255 N90-23883
- CARTER, DANIEL C.**  
Preliminary crystallographic examination of a novel fungal lysozyme from Chalaropsis p 243 A90-40377

- CASSERLY, DENNIS M.**  
Identifying atmospheric monitoring needs for Space Station Freedom p 264 N90-24977
- CHAN-PALAY, VICTORIA**  
Neurotransmitter and peptide localization in human brain  
[AD-A219964] p 249 N90-23873
- CHANCE, B.**  
Oxidative phosphorylation system during steady-state hypoxia in the dog brain p 243 A90-40074
- CHEVALLIER, J. R.**  
The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296
- CHOPP, C. S.**  
Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642
- COBB, B. L.**  
High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys  
[AD-A219570] p 245 N90-23863
- COLE, ROBERT E.**  
Stereo TV improves manipulator performance p 257 A90-38852
- COLOMBINA, G.**  
Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300
- CONNOLLY, THOMAS J.**  
Pilot decision-making training  
[AD-A221349] p 256 N90-24720
- CUBEROS, BERNABE C.**  
Analysis of the accuracy of a proposed target motion analysis procedure  
[AD-A219481] p 254 N90-23880
- CUSHING, STEVEN**  
From where they look to what they think: Determining controller cognitive strategies from oculometer scanning data p 256 N90-25041

## D

- DANDREA, JOHN A.**  
Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862  
High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys  
[AD-A219570] p 245 N90-23863  
Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888
- DANTZER, ROBERT**  
Reciprocal relationships between the immune and central nervous system  
[AD-A221259] p 245 N90-24712
- DAVIS, JOHN E.**  
Effect of fluid countermeasures of varying osmolality on cardiovascular responses to orthostatic stress p 251 N90-24978
- DELORGE, J. O.**  
Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862
- DEMPSEY, JEROME A.**  
Effects of high altitude hypoxia on lung and chest wall function during exercise  
[AD-A219814] p 248 N90-23869
- DEPUETER, W.**  
Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300
- DIDOT, F.**  
HERA and EVA co-operation scenarios p 261 N90-24299
- DOLLINS, ANDREW B.**  
Strategies to sustain and enhance performance in stressful environments  
[AD-A221224] p 245 N90-24711
- DUNHAM, DOUGLAS N.**  
Helmet mounted displays - Evaluation of impact on the operator p 258 A90-40384

**DUNLAP, WILLIAM P.**

Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644

**DURRANT-WHYTE, H.**

On-line estimation of human operator workload p 258 A90-40839

**DUTCHER, F. RONALD**

The biogeochemistry of metal cycling [NASA-CR-4295] p 265 N90-23897

**E****ELFVING, A.**

The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307

**ELLIS, STEPHEN R.**

Visions of visualization aids - Design philosophy and observations p 257 A90-38859

**ENDERLE, JOHN**

DURIP-Instrumentation for recording and analyzing multiple input/output saccadic eye movement neurosensory control [AD-A219905] p 248 N90-23871

**ERICKSON, J. D.**

A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

**ERWIN, DAVID N.**

High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

**EVANS, J. L.**

A flexible teleoperation test bed for human factors experimentation p 262 N90-24304

**F****FARHAT, NABIL H.**

Neuromorphic optical signal processing and image understanding for automated target recognition [AD-A219827] p 255 N90-23884

**FENDRICH, ROBERT**

DURIP: Improved eye movement monitoring capabilities for studies in visual cognition [AD-A220355] p 263 N90-24722

**FLOYD, LORETTA L.**

Brain stem evoked responses in altered G environments [AD-A220097] p 249 N90-23874

**G****GAUTHIER, GABRIEL M.**

The role of ocular muscle proprioception in visual localization of targets p 253 A90-40278

**GAWRON, VALERIE J.**

Effects of pyridostigmine bromide on in-flight aircrew performance p 247 A90-42288

**GEER, RICHARD D.**

Electrochemical control of iodine disinfectant for space transportation system and space station potable water p 264 N90-24981

**GIBSON, CHRIS P.**

Designing the virtual cockpit man-machine interface p 258 A90-40389

**GLASMACHERS, ROLAND**

Lunar shelter [ILR-MITT-233(1989)] p 260 N90-23896

**GLENN, KAREN G.**

Application of visual psychophysics to the design of video systems for use in space p 257 A90-38870

**GLENN, WILLIAM E.**

Application of visual psychophysics to the design of video systems for use in space p 257 A90-38870

**GNEVYSHEV, M. N.**

Biophysical and clinical aspects of heliobiology: Collection of scientific works p 244 A90-41954

**GOLDSTEIN, ROBERT**

Helmet mounted displays - Evaluation of impact on the operator p 258 A90-40384

**GOMEZ, JULIAN E.**

Scientific work environments in the next decade p 257 A90-38860

**GOREA, ANDREI**

A new paradigm for testing human and machine motion perception p 252 A90-38868

**GRANT, MICHAEL**

The application of kriging in the statistical analysis of anthropometric data, volume 1 [AD-A220613] p 260 N90-23891

The application of kriging in the statistical analysis of anthropometric data, volume 2 [AD-A220614] p 260 N90-23892

The application of kriging in the statistical analysis of anthropometric data, volume 3 [AD-A220615] p 260 N90-23893

**GREENLEAF, JOHN E.**

Hormonal regulation of fluid and electrolytes during prolonged bed rest - Implications for microgravity p 247 A90-40750

**GRINDELAND, R. E.**

Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646

**GRUNWALD, A.**

Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 254 A90-42455

**GUNZENHAUSER, JEFFREY D.**

Field evaluation of laser protective eyewear [AD-A221324] p 263 N90-24725

**GUTH, S. LEE**

Unified model for human color perception and visual adaptation p 253 A90-38872

**H****HACKNEY, ANTHONY C.**

Overtraining and exercise motivation: A research prospectus p 256 N90-24982

**HALEY, JOSEPH L., JR.**

Evaluation of the head injury hazard during military parachuting [AD-A220724] p 248 N90-23870

**HARDING, R. M.**

Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642

**HARRIMAN, ARTHUR E.**

Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology [AD-A221222] p 250 N90-24717

**HARTNESS, K. T.**

A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

**HASH, JOHN H.**

Preliminary crystallographic examination of a novel fungal lysozyme from Chalariopsis p 243 A90-40377

**HASSON, SCOTT M.**

Research in human performance related to space: A compilation of three projects/proposals p 264 N90-24983

**HE, XIAO-MIN**

Preliminary crystallographic examination of a novel fungal lysozyme from Chalariopsis p 243 A90-40377

**HENRY, REBECCA A.**

Adding a dimension: Time as a factor in the generalizability of predictive relationships [AD-A219679] p 259 N90-23890

**HERBER, N.**

The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296

**HICKMAN, JAMES R.**

High +Gz centrifuge training - The electrocardiographic response to +Gz-induced loss of consciousness p 246 A90-39643

**HIENERWADEL, KARL-OTTO**

Life support system - Dorniers contribution for space applications p 258 A90-41116

**HILPERT, R.**

Biosensors for the detection of heavy metal ions [MBB-Z-0289-89-PUB] p 245 N90-23864

**HIRSCH, E.**

A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875

**HIRSH, IRA J.**

Auditory perception of complex sounds [AD-A219927] p 249 N90-23872

**HITCHNER, LEWIS E.**

Psychophysical rating of image compression techniques p 252 A90-38866

**HOLDEN, R. D.**

Rapid decompression to 50,000 feet - Effect on heart rate response p 246 A90-39642

**HUBBARD, DAVID C.**

Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology [AD-A221222] p 250 N90-24717

**HULIN, CHARLES L.**

Adding a dimension: Time as a factor in the generalizability of predictive relationships [AD-A219679] p 259 N90-23890

**HUTCHINSON, RICHARD C.**

Low cost design alternatives for head mounted stereoscopic displays p 257 A90-38853

**I****IDAN, M.**

Effects of biodynamic coupling on the human operator model p 258 A90-40161

**ITO, HIDEYUKI**

Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels p 244 A90-41819

**K****KAISER, MARY K.**

Perceptual issues in scientific visualization p 252 A90-38858

**KASZUBA, JOHN**

Physiological and perceptual responses to prolonged treadmill load carriage [AD-A218809] p 247 N90-23865

**KELLEY, KEITH W.**

Reciprocal relationships between the immune and central nervous system [AD-A221259] p 245 N90-24712

**KENNEDY, ROBERT S.**

Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644

**KIDD, GARY R.**

Perception of complex auditory patterns [AD-A219626] p 248 N90-23867

**KITAGAKI, KOSEI**

Teleoperation of a force controlled robot manipulator without force feedback to a human operator p 262 N90-24305

**KLATZKY, ROBERTA L.**

Hand shaping: A paradigm for cognitive/motoric interaction [AD-A219908] p 255 N90-23885

**KLAUENBERG, S. JON**

High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

**KNEPTON, JAMES C.**

Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys [AD-A219455] p 244 N90-23862

High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting [AD-A219456] p 259 N90-23888

**KNUDSON, KATHRYN H. M.**

Field evaluation of laser protective eyewear [AD-A221324] p 263 N90-24725

**KONSTANTINOVA, IRENA V.**

Effects of spaceflight on levels and activity of immune cells p 243 A90-39647

**KOSSLYN, STEPHEN M.**

DURIP: Computational modeling of cognitive processes [AD-A219934] p 255 N90-23886

**KUECHLER, ANDREAS**

Lunar shelter [ILR-MITT-233(1989)] p 260 N90-23896

**L****LABINI, GIOVANNI SYLOS**

Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333

**LACHMAN, ROY**

Knowledge-based control of an adaptive interface p 264 N90-24987

**LAVITOLA, MARIA STELLA**

Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297

**LAWLESS, DESALES**

The effects of simulated hypogravity on murine bone marrow cells p 251 N90-24989

**LEMAI, MOIRA**

An empirically derived figure of merit for the quality of overall task performance p 265 N90-25058

**LESTER, L. S.**

A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875

**LI, K.-C.**

Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646



**LIEBERMAN, HARRIS R.**

Strategies to sustain and enhance performance in stressful environments  
[AD-A221224] p 245 N90-24711

**LUCIANI, RALPH J.**

Brain stem evoked responses in altered G environments  
[AD-A220097] p 249 N90-23874

**LUETTGEN, W.**

HERA and EVA co-operation scenarios  
p 261 N90-24299

**LURIA, SAUL M.**

Effect of extraneous color-coded targets on identification of targets on CRT displays  
[AD-A219473] p 254 N90-23879

**LYNE, JAMES E.**

Preliminary crystallographic examination of a novel fungal lysozyme from Chalazopsis p 243 A90-40377

**M****MADDALENA, DANILO**

Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations  
p 262 N90-24333

**MANCINELLI, ROCCO L.**

Model of carbon fixation in microbial mats from 3,500 Myr ago to the present p 243 A90-39821

**MANDEL, ADRIAN D.**

Effects of spaceflight on levels and activity of immune cells p 243 A90-39647

**MANNING, MARGARET H.**

A systematic approach to training: A training needs assessment p 257 N90-25059

**MARCUS, J. T.**

Vestibulo-ocular responses in man to +Gz hypergravity p 246 A90-39645

**MARSH, JAMES S.**

Optical factors in judgments of size through an aperture p 254 A90-42289

**MARTIN, STEPHEN W.**

Low cost design alternatives for head mounted stereoscopic displays p 257 A90-38853

**MARTIN, WAYNE L.**

Designing the virtual cockpit man-machine interface p 258 A90-40389

**MARZWELL, NEVILLE I.**

Telerobotic architecture for an on-orbit servicer p 262 N90-24302

**MASSO, JON D.**

Eye centered interferometric laser protection p 258 A90-40390

**MASTROIANNI, GEORGE R.**

Field evaluation of laser protective eyewear [AD-A221324] p 263 N90-24725

**MCGAUGH, JAMES L.**

Analysis of neural systems involved in modulation of memory storage [AD-A220230] p 250 N90-24714

**MELLO, ROBERT P.**

Physiological and perceptual responses to prolonged treadmill load carriage [AD-A218809] p 247 N90-23865

**MENENDEZ, ARTHUR R.**

Model for predicting the effects of laser exposures and eye protection on vision [AD-A219697] p 248 N90-23868

**MERHAV, S. J.**

Effects of biodynamic coupling on the human operator model p 258 A90-40161

**MERRITT, J. H.**

High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys [AD-A219570] p 245 N90-23863

**MILLER, JAMES C.**

Effects of pyridostigmine bromide on in-flight aircrew performance p 247 A90-42288

**MOLINE, M. L.**

A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875

**MOSER, MICHAEL**

Recurrent sinusitis and impairment of eustachian tube function in air passengers and crew p 247 A90-39649

**N****NAGY, ALLEN L.**

Critical color differences determined with a visual search task p 253 A90-40264

**NEALSON, KENNETH H.**

The biogeochemistry of metal cycling [NASA-CR-4295] p 265 N90-23897

**NEALSON, MOLLY**

The biogeochemistry of metal cycling [NASA-CR-4295] p 265 N90-23897

**NECHAY, BOHDAN R.**

Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity p 251 N90-24993

**NEGRIN, M.**

Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 254 A90-42455

**NERI, DAVID F.**

Effect of extraneous color-coded targets on identification of targets on CRT displays [AD-A219473] p 254 N90-23879

**NEWSOME, WILLIAM T.**

Cortical microstimulation influences perceptual judgements of motion direction p 244 A90-41874

**NIOKA, S.**

Oxidative phosphorylation system during steady-state hypoxia in the dog brain p 243 A90-40074

**NOMMAY, DANIELLE**

The role of ocular muscle proprioception in visual localization of targets p 253 A90-40278

**NOON, SHARON L.**

Adding a dimension: Time as a factor in the generalizability of predictive relationships [AD-A219679] p 259 N90-23890

**NORSWORTHY, R. S.**

A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

**O****O'HARE, DAVID**

Pilots' perception of risks and hazards in general aviation p 253 A90-39641

**ODENHEIMER, ROBERT C.**

Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644

**OGATA, MASAMI**

Motion perception model with interactions between spatial frequency channels p 253 A90-38869

**OL', A. I.**

Biophysical and clinical aspects of heliobiology: Collection of scientific works p 244 A90-41954

**P****PACE, JAMES M.**

A comparative analysis of work-hour forecasting techniques at the crew level [AD-A220706] p 260 N90-23894

**PALMER, RONALD W.**

Evaluation of the head injury hazard during military parachuting [AD-A220724] p 248 N90-23870

**PANITZ, CORINNA**

In vitro photoreactivation of transforming DNA of bacillus subtilis spores after irradiation with UV light [DLR-FB-89-45] p 245 N90-24710

**PAPATHOMAS, THOMAS V.**

A new paradigm for testing human and machine motion perception p 252 A90-38868

**PARKER, DONNA L.**

Stereo TV improves manipulator performance p 257 A90-38852

**PASCHAL, CHARLES R., JR.**

Evaluation of the head injury hazard during military parachuting [AD-A220724] p 248 N90-23870

**PATTON, JOHN F.**

Physiological and perceptual responses to prolonged treadmill load carriage [AD-A218809] p 247 N90-23865

**PEARSONS, KARL S.**

Analyses of the predictability of noise-induced sleep disturbance [AD-A220156] p 249 N90-23876

**PELLEGRINO, JAMES W.**

Hand shaping: A paradigm for cognitive/motoric interaction [AD-A219908] p 255 N90-23885

**PHINNEY, D. E.**

A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

**POLLAK, C. P.**

A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875

**POLLOCK, RANDY BETH**

An investigation into techniques for landmark identification of 3D images of human subjects, phase 1 [AD-A218614] p 250 N90-24713

**PORTER, HENRY O.**

Aviators intoxicated by inhalation of JP-5 fuel vapors p 247 A90-39648

**PREISS, HELMUT**

Life support system - Dorniers contribution for space applications p 258 A90-41116

**PRENDIN, WALTER**

Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333

**PROFFITT, DENNIS R.**

Perceptual issues in scientific visualization p 252 A90-38858

**PUTZ, P.**

Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300

**R****RASH, CLARENCE E.**

Human factors and safety considerations of night vision systems flight p 258 A90-40380

**RATINO, DAVID A.**

Brain stem evoked responses in altered G environments [AD-A220097] p 249 N90-23874

**RENCKEN, W. D.**

On-line estimation of human operator workload p 258 A90-40839

**REYNOLDS, KATY L.**

Physiological and perceptual responses to prolonged treadmill load carriage [AD-A218809] p 247 N90-23865

**RODRIGUEZ, LOUIS E.**

Brain stem evoked responses in altered G environments [AD-A220097] p 249 N90-23874

**ROGOWITZ, BERNICE E.**

Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989 [SPIE-1077] p 252 A90-38864

**ROSEN, A.**

Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 254 A90-42455

**ROTHSCHILD, LYNN J.**

Model of carbon fixation in microbial mats from 3,500 Myr ago to the present p 243 A90-39821

**RUDGE, FREDERICK W.**

Decompression sickness affecting the temporomandibular joint [AD-A220959] p 250 N90-24715

**RUFFNER, JOHN W.**

A survey of human factors methodologies and models for improving the maintainability design of emerging Army aviation systems [AD-A221159] p 263 N90-24724

**S****SALEM, G. J.**

Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646

**SALTER, C. A.**

A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875

**SALZMAN, C. DANIEL**

Cortical microstimulation influences perceptual judgements of motion direction p 244 A90-41874

**SANCHEZ, ROBERT R.**

Critical color differences determined with a visual search task p 253 A90-40264

**SATO, TAKAO**

Motion perception model with interactions between spatial frequency channels p 253 A90-38869

**SCHIFFLETT, SAMUEL G.**

Effects of pyridostigmine bromide on in-flight aircrew performance p 247 A90-42288

**SCHNEIDER, SID J.**

Voice measures of workload in the advanced flight deck: Additional studies [NASA-CR-4258] p 259 N90-23887

**SCHOONEJANS, P.**

The Hermes robot arm teleoperation and control concept p 261 N90-24301

## SHANAHAN, DENNIS F.

Evaluation of the head injury hazard during military parachuting  
[AD-A220724] p 248 N90-23870

## SHEEHY, JAMES B.

Dazzling glare: Protection criteria versus visual performance  
[AD-A219676] p 259 N90-23889

## SHENDER, BARRY SCOTT

Rheoencephalography in simulated aviation environmental stress  
[AD-A221150] p 250 N90-24716

## SHIM, MATTHEW J.

Effect of extraneous color-coded targets on identification of targets on CRT displays  
[AD-A219473] p 254 N90-23879

## SHIMADA, STEVEN G.

Effects of cold and capsaicin desensitization on prostaglandin E hypothermia in rats p 243 A90-40075

## SHIOYA, MASAKATSU

Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels p 244 A90-41819

## SILVERSTEIN, LOUIS D.

Limits of fusion and depth judgment in stereoscopic color displays p 254 A90-42286

## SIOMIONESCO, L.

The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296

## SKOOG, A. I.

The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296

## SLATER, TIMOTHY

Effects of pyridostigmine bromide on in-flight aircrew performance p 247 A90-42288

## SMITH, D. S.

Oxidative phosphorylation system during steady-state hypoxia in the dog brain p 243 A90-40074

## SMITH, PETER A.

Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868

## SONNENFELD, GERALD

Effects of spaceflight on levels and activity of immune cells p 243 A90-39647

## SQUIRES, W. G.

The use of underwater dynamometry to evaluate two space suits p 264 N90-24995

## STAMPER, DAVID A.

Field evaluation of laser protective eyewear  
[AD-A221324] p 263 N90-24725

## STANNY, R. R.

Mental lapses and event-related potentials  
[AD-A219454] p 254 N90-23878

## STEIN, CHARLES S.

Psychophysical rating of image compression techniques p 252 A90-38866

## STERBA, JOHN A.

Field management of accidental hypothermia during diving  
[AD-A219560] p 247 N90-23866

## STERN, JOHN A.

Helmet mounted displays - Evaluation of impact on the operator p 258 A90-40384

## STITT, JOHN T.

Effects of cold and capsaicin desensitization on prostaglandin E hypothermia in rats p 243 A90-40075

## STRACHAN, I. G. D.

A flexible teleoperation test bed for human factors experimentation p 262 N90-24304

## STUBBS, GERALD

Preliminary crystallographic examination of a novel fungal lysozyme from *Chalaropsis* p 243 A90-40377

## STUCK, BRUCE E.

Field evaluation of laser protective eyewear  
[AD-A221324] p 263 N90-24725

## SUBRAMANIAN, H. V.

Oxidative phosphorylation system during steady-state hypoxia in the dog brain p 243 A90-40074

## T

## TABACHNICK, BARBARA G.

Analyses of the predictability of noise-induced sleep disturbance  
[AD-A220156] p 249 N90-23876

## TAFFORIN, CAROLE

Relationships between orientation, movement and posture in weightlessness - Preliminary ethological observations p 246 A90-38929

## TAIRA, TAKAHIRO

Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels p 244 A90-41819

## TAKAHASHI, SHUSHICHI

Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels p 244 A90-41819

## TAKEKURA, HIROAKI

Effect of body suspension hypokinesia on skeletal muscle trained previously by endurance exercise p 244 A90-41820

## TAYLOR, GERALD R.

Effects of spaceflight on levels and activity of immune cells p 243 A90-39647

## TEMME, LEONARD A.

Optical factors in judgments of size through an aperture p 254 A90-42289

## TERRIBLE, ANTONIO

Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333

## THACKRAY, RICHARD I.

Effects of monitoring under high and low taskload on detection of flashing and colored radar targets  
[AD-A220313] p 260 N90-23895

## THORNTON, WILLIAM A.

A new approach to laser filters p 258 A90-40391

## TITTMAR, HEINZ-GUNTHER

Biological and cognitive determination of the gravitational reference frame p 253 A90-38928

## TOUCHSTONE, R. MARK

Effects of monitoring under high and low taskload on detection of flashing and colored radar targets  
[AD-A220313] p 260 N90-23895

## TOUSSAINT, MARC

Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297

## U

## UCHIYAMA, MASARU

Teleoperation of a force controlled robot manipulator without force feedback to a human operator p 262 N90-24305

## V

## VAILAS, A. C.

Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646

## VAN HOLTEN, C. R.

Vestibulo-ocular responses in man to +Gz hypergravity p 246 A90-39645

## VERCHER, JEAN-LOUIS

The role of ocular muscle proprioception in visual localization of targets p 253 A90-40278

## VERONA, ROBERT W.

Human factors and safety considerations of night vision systems flight p 258 A90-40380

## W

## WALTER, GERVINO

Life support system - Dorniers contribution for space applications p 258 A90-41116

## WATSON, ANDREW B.

Receptive fields and visual representations p 252 A90-38865

Psychophysical rating of image compression techniques p 252 A90-38866

## WATSON, CHARLES S.

Perception of complex auditory patterns  
[AD-A219626] p 248 N90-23867

## WHINNERY, ANGELA M.

High +Gz centrifuge training - The electrocardiographic response to +Gz-induced loss of consciousness p 246 A90-39643

## WHINNERY, JAMES E.

High +Gz centrifuge training - The electrocardiographic response to +Gz-induced loss of consciousness p 246 A90-39643

## WICKENS, CHRISTOPHER D.

Proximity compatibility and information display - Effects of color, space, and objectness on information integration p 254 A90-42287

## WILSON, GLENN F.

Brain stem evoked responses in altered G environments  
[AD-A220097] p 249 N90-23874

## WOLF, GERALD

Recurrent sinusitis and impairment of eustachian tube function in air passengers and crew p 247 A90-39649

## WOOD, CHARLES D.

Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644

## Y

## YAMAZAKI, JUNKO

Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels p 244 A90-41819

## YEH, YEI-YU

Limits of fusion and depth judgment in stereoscopic color displays p 254 A90-42286

## YIN, PAUL K.

A preliminary design of interior structure and foundation of an inflatable lunar habitat p 264 N90-24999

## YOSHIOKA, TOSHITADA

Effect of body suspension hypokinesia on skeletal muscle trained previously by endurance exercise p 244 A90-41820

## Z

## ZACKSENHOUSE, M.

A prototype autonomous agent for crew and equipment retrieval in space p 259 A90-41198

## ZENDELL, S.

A laboratory study of the effects of diet and bright light countermeasures to jet lag  
[AD-A220148] p 249 N90-23875

## ZENK, M. H.

Biosensors for the detection of heavy metal ions  
[MBB-Z-0289-89-PUB] p 245 N90-23864

## ZERNICKE, R. F.

Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646

## ZHANG, JINGXUE

Study of acute hypoxic effect on human performance under aerospace conditions p 246 A90-39321

## ZHAO, JIANMIN

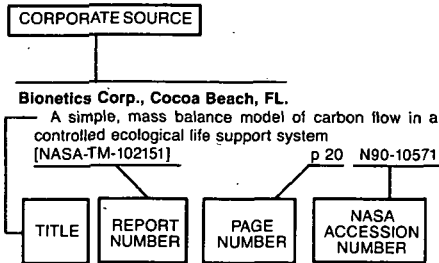
Real time inverse kinematics with joint limits and spatial constraints  
[AD-A220462] p 263 N90-24723

# CORPORATE SOURCE INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 341)

October 1990

## Typical Corporate Source Index Listing



Listings in\*this index are arranged alphabetically by corporate source. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

## A

- Aeritalia S.p.A., Turin (Italy).**  
Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297
- Aerospace Medical Research Labs., Wright-Patterson AFB, OH.**  
Brain stem evoked responses in altered G environments [AD-A220097] p 249 N90-23874
- Air Force Human Resources Lab., Brooks AFB, TX.**  
Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology [AD-A221222] p 250 N90-24717
- Air Force Inst. of Tech., Wright-Patterson AFB, OH.**  
The application of kriging in the statistical analysis of anthropometric data, volume 1 [AD-A220613] p 260 N90-23891  
The application of kriging in the statistical analysis of anthropometric data, volume 2 [AD-A220614] p 260 N90-23892  
The application of kriging in the statistical analysis of anthropometric data, volume 3 [AD-A220615] p 260 N90-23893
- Alabama Univ., Tuscaloosa.**  
Noninvasive estimation of fluid shifts between body compartments by measurement of bioelectric characteristics p 251 N90-24976
- Alma Coll., MI.**  
Effect of fluid countermeasures of varying osmolality on cardiovascular responses to orthostatic stress p 251 N90-24978
- Anacapa Sciences, Inc., Fort Rucker, AL.**  
A survey of human factors methodologies and models for improving the maintainability design of emerging Army aviation systems [AD-A221159] p 263 N90-24724

- Armstrong State Coll., Savannah, GA.**  
Effect of low air velocities on thermal homeostasis and comfort during exercise at space station operational temperature and humidity p 263 N90-24975
- Army Aeromedical Research Lab., Fort Rucker, AL.**  
Evaluation of the head injury hazard during military parachuting [AD-A220724] p 248 N90-23870
- Army Natick Research and Development Command, MA.**  
A laboratory study of the effects of diet and bright light countermeasures to jet lag [AD-A220148] p 249 N90-23875
- Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.**  
The incremental validity of spatial and perceptual-psychomotor tests relative to the armed services vocational aptitude battery [AD-A220903] p 256 N90-24719
- Army Research Inst. of Environmental Medicine, Natick, MA.**  
Physiological and perceptual responses to prolonged treadmill load carriage [AD-A218809] p 247 N90-23865
- Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).**  
The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296

## B

- BBN Systems and Technologies Corp., Canoga Park, CA.**  
Analyses of the predictability of noise-induced sleep disturbance [AD-A220156] p 249 N90-23876
- Behavioral Health Systems, Inc., Ossining, NY.**  
Voice measures of workload in the advanced flight deck: Additional studies [NASA-CR-4258] p 259 N90-23887
- British Aerospace Dynamics Group, Bristol (England).**  
A flexible teleoperation test bed for human factors experimentation p 262 N90-24304

## C

- California Univ., Berkeley.**  
Visions of visualization aids - Design philosophy and observations p 257 A90-38859
- California Univ., Irvine.**  
Analysis of neural systems involved in modulation of memory storage [AD-A220230] p 250 N90-24714
- California Univ., Los Angeles.**  
Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics p 243 A90-39646
- California Univ., Santa Barbara.**  
Hand shaping: A paradigm for cognitive/motoric interaction [AD-A219908] p 255 N90-23885
- California Univ., Santa Cruz.**  
Psychophysical rating of image compression techniques p 252 A90-38866
- Central Inst. for the Deaf, Saint Louis, MO.**  
Auditory perception of complex sounds [AD-A219927] p 249 N90-23872
- Centre National d'Etudes Spatiales, Toulouse (France).**  
HERA teleoperation test facility p 262 N90-24303

## D

- Dartmouth Coll., Hanover, NH.**  
DURIP: Improved eye movement monitoring capabilities for studies in visual cognition [AD-A220355] p 263 N90-24722
- Dayton Univ., OH.**  
Effects of pyridostigmine bromide on A-10 pilots during execution of a simulated mission: Physiology [AD-A221222] p 250 N90-24717

- Department of Energy, Washington, DC.**  
Understanding our genetic inheritance. The US Human genome project: The first five years, FY 1991-1995 [DE90-008240] p 250 N90-24718
- Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.).**  
In vitro photoreactivation of transforming DNA of bacillus subtilis spores after irradiation with UV light [DLR-FB-89-45] p 245 N90-24710

## E

- Embry-Riddle Aeronautical Univ., Daytona Beach, FL.**  
Pilot decision-making training [AD-A221349] p 256 N90-24720
- Essex Corp., Orlando, FL.**  
Differential effects of scopolamine and amphetamine on microcomputer-based performance tests p 246 A90-39644
- European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).**  
HERA and EVA co-operation scenarios p 261 N90-24299  
Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300  
The European EVA spacesuit mechanisms p 263 N90-24481

## F

- Federal Aviation Administration, Oklahoma City, OK.**  
Effects of monitoring under high and low taskload on detection of flashing and colored radar targets [AD-A220313] p 260 N90-23895
- Fordham Univ., New York, NY.**  
The effects of simulated hypogravity on murine bone marrow cells p 251 N90-24989

## H

- Hampton Univ., VA.**  
A systematic approach to training: A training needs assessment p 257 N90-25059
- Harvard Univ., Cambridge, MA.**  
DURIP: Computational modeling of cognitive processes [AD-A219934] p 255 N90-23886
- Houston Univ., Clear Lake, TX.**  
Identifying atmospheric monitoring needs for Space Station Freedom p 264 N90-24977
- Houston Univ., TX.**  
Knowledge-based control of an adaptive interface p 264 N90-24987

## I

- IBM Watson Research Center, Yorktown Heights, NY.**  
Human vision, visual processing, and digital display; Proceedings of the Meeting, Los Angeles, CA, Jan. 18-20, 1989 [SPIE-1077] p 252 A90-38864
- Illinois Univ., Champaign.**  
Adding a dimension: Time as a factor in the generalizability of predictive relationships [AD-A219679] p 259 N90-23890
- Illinois Univ., Urbana.**  
Reciprocal relationships between the immune and central nervous system [AD-A221259] p 245 N90-24712
- Indiana Univ., Bloomington.**  
Perception of complex auditory patterns [AD-A219626] p 248 N90-23867
- Institute of Biomedical Problems, Moscow (USSR).**  
Effects of spaceflight on levels and activity of immune cells p 243 A90-39647

SOURCE

## J

- Jet Propulsion Lab., California Inst. of Tech., Pasadena.**  
Telerobotic architecture for an on-orbit servicer  
p 262 N90-24302

## L

- Letterman Army Inst. of Research, San Francisco, CA.**  
Field evaluation of laser protective eyewear  
[AD-A221324] p 263 N90-24725
- Lockheed Engineering and Sciences Co., Houston, TX.**  
A prototype autonomous agent for crew and equipment retrieval in space  
p 259 A90-41198
- Louisville Univ., KY.**  
Effects of spaceflight on levels and activity of immune cells  
p 243 A90-39647

## M

- Massachusetts Inst. of Tech., Cambridge.**  
Strategies to sustain and enhance performance in stressful environments  
[AD-A221224] p 245 N90-24711
- MATRA Espace, Paris-Velizy (France).**  
The Hermes robot arm teleoperation and control concept  
p 261 N90-24301  
The bi-arm servicer: A multimission concept and a technological model for space robotics  
p 262 N90-24307
- McDonnell-Douglas Space Systems Co., Huntington Beach, CA.**  
Telerobotic application to EVA  
p 261 N90-24298
- Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).**  
Biosensors for the detection of heavy metal ions  
[MBB-Z-0289-89-PUB] p 245 N90-23864
- Montana State Univ., Bozeman.**  
Electrochemical control of iodine disinfectant for space transportation system and space station potable water  
p 264 N90-24981
- Montclair State Coll., Upper Montclair, NJ.**  
An empirically derived figure of merit for the quality of overall task performance  
p 265 N90-25058

## N

- National Aeronautics and Space Administration, Washington, DC.**  
Strategic implementation plan  
[NASA-TM-102907] p 244 N90-23861
- Aerospace medicine and biology: A continuing bibliography with indexes (supplement 336)  
[NASA-SP-7011(336)] p 249 N90-23877
- National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.**  
Perceptual issues in scientific visualization  
p 252 A90-38858
- Visions of visualization aids - Design philosophy and observations  
p 257 A90-38859
- Scientific work environments in the next decade  
p 257 A90-38860
- Receptive fields and visual representations  
p 252 A90-38865
- Psychophysical rating of image compression techniques  
p 252 A90-38866
- Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics  
p 243 A90-39646
- Effects of spaceflight on levels and activity of immune cells  
p 243 A90-39647
- Model of carbon fixation in microbial mats from 3,500 Myr ago to the present  
p 243 A90-39821
- Hormonal regulation of fluid and electrolytes during prolonged bed rest - Implications for microgravity  
p 247 A90-40750
- National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, TX.**  
Effects of spaceflight on levels and activity of immune cells  
p 243 A90-39647
- A prototype autonomous agent for crew and equipment retrieval in space  
p 259 A90-41198
- National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, AL.**  
Preliminary crystallographic examination of a novel fungal lysozyme from *Chalaropsis*  
p 243 A90-40377
- National Aerospace Medical Centre, Soesterberg (Netherlands).**  
Activities report of the National Aerospace Medical Center  
[ETN-90-96936] p 256 N90-24721

## National Defence Research Establishment, Stockholm (Sweden).

- Target selection in anti-tank helicopter operations: Relative weight of cues in target evaluation judgements  
[FOA-C-50072-5.2] p 255 N90-23881
- Target selection in anti-tank operations: Effects of experience  
[FOA-C-50073-5.2] p 255 N90-23882

- Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire  
[FOA-C-50074-5.2] p 255 N90-23883

## National Inst. of Health, Bethesda, MD.

- Understanding our genetic inheritance. The US Human genome project: The first five years, FY 1991-1995  
[DE90-008240] p 250 N90-24718

## Naval Aerospace Medical Research Lab., Pensacola, FL

- Effects of cholinergic drugs on exercise performance and simple reaction time of rhesus monkeys  
[AD-A219455] p 244 N90-23862
- High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys  
[AD-A219570] p 245 N90-23863
- Mental lapses and event-related potentials  
[AD-A219454] p 254 N90-23878
- Effect of laser glare and aircraft windscreen on visual search performance under low ambient lighting  
[AD-A219456] p 259 N90-23888

## Naval Air Development Center, Warminster, PA.

- Dazzling glare: Protection criteria versus visual performance  
[AD-A219676] p 259 N90-23889
- Rheoencephalography in simulated aviation environmental stress  
[AD-A221150] p 250 N90-24716

## Naval Postgraduate School, Monterey, CA.

- Analysis of the accuracy of a proposed target motion analysis procedure  
[AD-A219481] p 254 N90-23880

## Naval Submarine Medical Research Lab., Groton, CT.

- Effect of extraneous color-coded targets on identification of targets on CRT displays  
[AD-A219473] p 254 N90-23879

## Navy Experimental Diving Unit, Panama City, FL.

- Field management of accidental hypothermia during diving  
[AD-A219560] p 247 N90-23866

## New York Inst. of Tech., Dania, FL.

- Application of visual psychophysics to the design of video systems for use in space  
p 257 A90-38870

## North Carolina Univ., Chapel Hill.

- Overttraining and exercise motivation: A research prospectus  
p 256 N90-24982

## North Dakota State Univ., Fargo.

- DURIP-Instrumentation for recording and analyzing multiple input/output saccadic eye movement neurosensory control  
[AD-A219905] p 248 N90-23871

## P

## Pennsylvania State Univ., University Park.

- A comparative analysis of work-hour forecasting techniques at the crew level  
[AD-A220706] p 260 N90-23894

## Pennsylvania Univ., Philadelphia.

- Neuromorphic optical signal processing and image understanding for automated target recognition  
[AD-A219827] p 255 N90-23884
- Real time inverse kinematics with joint limits and spatial constraints  
[AD-A220462] p 263 N90-24723

## S

## School of Aerospace Medicine, Brooks AFB, TX.

- High peak power microwave pulses at 2.37 GHz: No effects on vigilance performance in monkeys  
[AD-A219570] p 245 N90-23863
- Model for predicting the effects of laser exposures and eye protection on vision  
[AD-A219697] p 248 N90-23868
- Decompression sickness affecting the temporomandibular joint  
[AD-A220959] p 250 N90-24715

## Stonehill Coll., North Easton, MA.

- From where they look to what they think: Determining controller cognitive strategies from oculometer scanning data  
p 256 N90-25041

## T

## Technische Univ., Berlin (Germany, F.R.).

- Lunar shelter  
[ILR-MITT-233(1989)] p 260 N90-23896

## Tecnomare S.p.A. (Italy).

- Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations  
p 262 N90-24333

## Texas A&amp;M Univ., Galveston.

- A preliminary design of interior structure and foundation of an inflatable lunar habitat  
p 264 N90-24999

## Texas Lutheran Coll., Seguin.

- The use of underwater dynamometry to evaluate two space suits  
p 264 N90-24995

## Texas Univ., Galveston.

- Research in human performance related to space: A compilation of three projects/proposals  
p 264 N90-24983

- Conservation of body calcium by increased dietary intake of potassium: A potential measure to reduce the osteoporosis process during prolonged exposure to microgravity  
p 251 N90-24993

## Tohoku Univ., Sendai (Japan).

- Teleoperation of a force controlled robot manipulator without force feedback to a human operator  
p 262 N90-24305

## U

## Universal Energy Systems, Inc., Dayton, OH.

- An investigation into techniques for landmark identification of 3D images of human subjects, phase 1  
[AD-A218614] p 250 N90-24713

## V

## Vanderbilt Univ., Nashville, TN.

- Preliminary crystallographic examination of a novel fungal lysozyme from *Chalaropsis*  
p 243 A90-40377

## Virginia Univ., Charlottesville.

- Perceptual issues in scientific visualization  
p 252 A90-38858

## W

## Wisconsin Univ., Madison.

- Interactive effects of nutrition, environment, and rat-strain on cortical and vertebral bone geometry and biomechanics  
p 243 A90-39646
- Effects of high altitude hypoxia on lung and chest wall function during exercise  
[AD-A219814] p 248 N90-23869

## Wisconsin Univ., Milwaukee.

- The biogeochemistry of metal cycling  
[NASA-CR-4295] p 265 N90-23897

## Z

## Zurich Univ. (Switzerland).

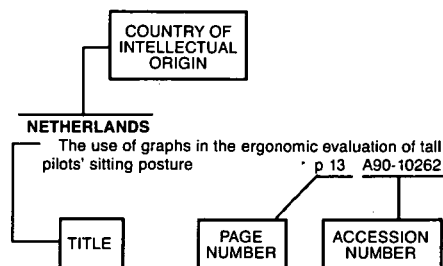
- Neurotransmitter and peptide localization in human brain  
[AD-A219964] p 249 N90-23873

# FOREIGN TECHNOLOGY INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 341)

October 1990

## Typical Foreign Technology Index Listing



Listings in this index are arranged alphabetically by country of intellectual origin. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the citation in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

## A

### AUSTRIA

Recurrent sinusitis and impairment of eustachian tube function in air passengers and crew p 247 A90-39649

## C

### CHINA, PEOPLE'S REPUBLIC OF

Study of acute hypoxic effect on human performance under aerospace conditions p 246 A90-39321

## F

### FRANCE

Relationships between orientation, movement and posture in weightlessness - Preliminary ethological observations p 246 A90-38929  
The role of ocular muscle proprioception in visual localization of targets p 253 A90-40278  
The European EVA suit: An optimized tool for Hermes/MTFF in-orbit operations p 261 N90-24296  
The Hermes robot arm teleoperation and control concept p 261 N90-24301  
HERA teleoperation test facility p 262 N90-24303  
The bi-arm servicer: A multimission concept and a technological model for space robotics p 262 N90-24307

## G

### GERMANY, FEDERAL REPUBLIC OF

Life support system - Domiers contribution for space applications p 258 A90-41116  
Biosensors for the detection of heavy metal ions [MBB-Z-0289-89-PUB] p 245 N90-23864  
Lunar shelter [ILR-MITT-233(1989)] p 260 N90-23896

In vitro photoreactivation of transforming DNA of bacillus subtilis spores after irradiation with UV light [DLR-FB-89-45] p 245 N90-24710

## I

### ISRAEL

Effects of biodynamic coupling on the human operator model p 258 A90-40161  
Superimposed perspective visual cues for helicopter hovering above a moving ship deck p 254 A90-42455

### ITALY

Perspective features of internal automation and robotics for supporting Columbus attached laboratory payload operations p 261 N90-24297  
Supervisory controlled telemanipulation and vision systems for inspection and maintenance operations p 262 N90-24333

## J

### JAPAN

Motion perception model with interactions between spatial frequency channels p 253 A90-38869  
Electronic modulation of biomaterial functions p 244 A90-41265  
Effect of centrifugation acceleration for 3 week's 2G on growth in developing cockerels p 244 A90-41819  
Effect of body suspension hypokinesia on skeletal muscle trained previously by endurance exercise p 244 A90-41820  
Teleoperation of a force controlled robot manipulator without force feedback to a human operator p 262 N90-24305

## N

### NETHERLANDS

Vestibulo-ocular responses in man to +Gz hypergravity p 246 A90-39645  
HERA and EVA co-operation scenarios p 261 N90-24299  
Robot-based equipment manipulation and transportation for the Columbus free flying laboratory p 261 N90-24300  
The European EVA spacesuit mechanisms p 263 N90-24481  
Activities report of the National Aerospace Medical Center [ETN-90-96936] p 256 N90-24721

### NEW ZEALAND

Pilots' perception of risks and hazards in general aviation p 253 A90-39641

## S

### SWEDEN

Target selection in anti-tank helicopter operations: Relative weight of cues in target evaluation judgements [FOA-C-50072-5.2] p 255 N90-23881  
Target selection in anti-tank operations: Effects of experience [FOA-C-50073-5.2] p 255 N90-23882  
Mode of presentation of cues in policy capturing: A comparison between verbal and pictorial presentation of targets in judgement of probability to fire [FOA-C-50074-5.2] p 255 N90-23883

### SWITZERLAND

Neurotransmitter and peptide localization in human brain [AD-A219964] p 249 N90-23873

## U

### U.S.S.R.

Biophysical and clinical aspects of heliobiology: Collection of scientific works p 244 A90-41954

### UNITED KINGDOM

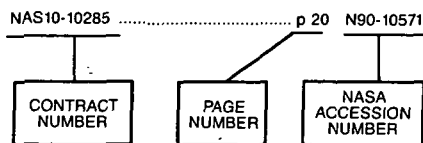
Biological and cognitive determination of the gravitational reference frame p 253 A90-38928  
Designing the virtual cockpit man-machine interface p 258 A90-40389  
On-line estimation of human operator workload p 258 A90-40839  
A flexible teleoperation test bed for human factors experimentation p 262 N90-24304

# CONTRACT NUMBER INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 341)

October 1990

## Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under the contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

NIH-GM-33265	p 243	A90-40377
NIH-HL-07286	p 243	A90-40074
NIH-NS-11487	p 243	A90-40075
NIH-NS-22881	p 243	A90-40074
NIH-NS-23859	p 243	A90-40074
NIH-NS-62307	p 243	A90-40074
NIH-5-R01-DK-35882	p 243	A90-40075
NSF DMC-85-16114	p 263	N90-24723
NSF IRI-84-10413	p 263	N90-24723
NSF IST-86-12984	p 263	N90-24723
NSF MCS-82-19196	p 263	N90-24723
NSF PCM-76-09691	p 243	A90-40377
N00014-87-K-0518	p 250	N90-24714
N00014-89-J-1956	p 245	N90-24712
N00228-85-G-3278	p 260	N90-23894
505-67-11-01	p 259	N90-23887

AF PROJ. 2312	p 249	N90-23873
	p 245	N90-24711
AF PROJ. 2313	p 248	N90-23867
	p 249	N90-23872
	p 255	N90-23885
AF PROJ. 3037	p 249	N90-23876
AF PROJ. 3842	p 248	N90-23871
	p 255	N90-23886
	p 263	N90-24722
AF PROJ. 7184	p 249	N90-23874
	p 250	N90-24713
AF PROJ. 7757	p 245	N90-23863
	p 248	N90-23868
AF-AFOSR-0090-89	p 255	N90-23886
AF-AFOSR-0092-89	p 248	N90-23871
AF-AFOSR-0176-86	p 249	N90-23873
AF-AFOSR-0191-89	p 263	N90-24722
AF-AFOSR-0230-87	p 255	N90-23885
AF-AFOSR-0300-87	p 248	N90-23867
AF-AFOSR-0382-87	p 249	N90-23872
AF-AFOSR-0402-87	p 245	N90-24711
AF-AFOSR-87-0089	p 253	A90-38872
DA PROJ. 1L1-62786-AH-99	p 249	N90-23875
DA PROJ. 2Q2-63007-A-793	p 263	N90-24724
DA PROJ. 3E1-62787-A-879	p 247	N90-23865
DA PROJ. 3E1-62787-A8-78	p 248	N90-23870
DA PROJ. 3M1-62787-A-879	p 248	N90-23869
DAAA15-86-K-0013	p 254	A90-42287
DAAA21-89-M-0554	p 258	A90-40391
DAAG29-84-K-0061	p 263	N90-24723
DAAG29-84-G-0027	p 263	N90-24723
DAAG60-88-C-0100	p 249	N90-23875
DAAL03-89-C-0031	p 263	N90-24723
DAMD17-88-C-8053	p 248	N90-23869
DAMD17-88-C-8194	p 258	A90-40391
ESTEC-7790/88/NL/PB(SC)	p 263	N90-24481
ESTEC-7946/87	p 262	N90-24307
F33615-85-C-0514	p 258	A90-40384
F33615-86-C-0530	p 249	N90-23876
F33615-87-C-0014	p 259	N90-23890
F49620-88-C-0053	p 250	N90-24713
MDA903-87-C-0523	p 263	N90-24724
NAG2-479	p 243	A90-39646
NAG9-234	p 243	A90-39647
NASW-4242	p 257	A90-38870
NASW-4324	p 265	N90-23897
NAS1-18278	p 259	N90-23887
NAS9-17326	p 246	A90-39644
NCC2-541	p 252	A90-38861
NIH-AG-06551	p 252	A90-38861
NIH-AI-06712	p 243	A90-40377

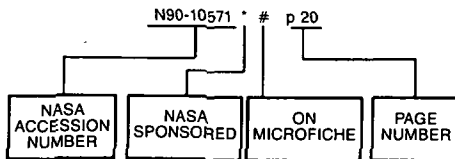
CONTRACT



## October 1990

# ACCESSION NUMBER INDEX

## Typical Accession Number Index Listing



Listings in this index are arranged alphanumerically by accession number. The page number listed to the right indicates the page on which the citation is located. An asterisk (\*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

N90-24717 # p 250  
 N90-24718 # p 250  
 N90-24719 # p 256  
 N90-24720 # p 256  
 N90-24721 # p 256  
 N90-24722 # p 263  
 N90-24723 # p 263  
 N90-24724 # p 263  
 N90-24725 # p 263  
 N90-24975 # p 263  
 N90-24976 # p 251  
 N90-24977 # p 264  
 N90-24978 # p 251  
 N90-24981 # p 264  
 N90-24982 # p 256  
 N90-24983 # p 264  
 N90-24987 # p 264  
 N90-24989 # p 251  
 N90-24993 # p 251  
 N90-24995 # p 264  
 N90-24999 # p 264  
 N90-25041 # p 256  
 N90-25058 # p 265  
 N90-25059 # p 257

A90-38852	p 257	N90-23863	# p 245
A90-38853	p 257	N90-23864	# p 245
A90-38858 *	p 252	N90-23865	# p 247
A90-38859 *	p 257	N90-23866	# p 247
A90-38860 *	p 257	N90-23867	# p 248
A90-38861 *	p 252	N90-23868	# p 248
A90-38864	p 252	N90-23869	# p 248
A90-38865 *	p 252	N90-23870	# p 248
A90-38866 *	p 252	N90-23871	# p 248
A90-38868	p 252	N90-23872	# p 249
A90-38869	p 253	N90-23873	# p 249
A90-38870 *	p 257	N90-23874	# p 249
A90-38871	p 253	N90-23875	# p 249
A90-38872	p 253	N90-23876	# p 249
A90-38928	p 253	N90-23877 *	p 249
A90-38929	p 246	N90-23878	# p 254
A90-39321 #	p 246	N90-23879	# p 254
A90-39641	p 253	N90-23880	# p 254
A90-39642	p 246	N90-23881	# p 255
A90-39643	p 246	N90-23882	# p 255
A90-39644 *	p 246	N90-23883	# p 255
A90-39645	p 246	N90-23884	# p 255
A90-39646 *	p 243	N90-23885	# p 255
A90-39647 *	p 243	N90-23886	# p 255
A90-39648	p 247	N90-23887 *	p 259
A90-39649	p 247	N90-23888	# p 259
A90-39821 *	p 243	N90-23889	# p 259
A90-40074	p 243	N90-23890	# p 259
A90-40075	p 243	N90-23891	# p 260
A90-40161 #	p 258	N90-23892	# p 260
A90-40264	p 253	N90-23893	# p 260
A90-40278	p 253	N90-23894	# p 260
A90-40377 *	p 243	N90-23895	# p 260
A90-40380	p 258	N90-23896	# p 260
A90-40384	p 258	N90-23897 *	p 265
A90-40389	p 258	N90-24296	# p 261
A90-40390	p 258	N90-24297	# p 261
A90-40391	p 258	N90-24298	# p 261
A90-40750 *	p 247	N90-24299	# p 261
A90-40839	p 258	N90-24300	# p 261
A90-41116 #	p 258	N90-24301	# p 261
A90-41198 *	p 259	N90-24302 *	p 262
A90-41265	p 244	N90-24303	# p 262
A90-41819	p 244	N90-24304	# p 262
A90-41820	p 244	N90-24305	# p 262
A90-41874	p 244	N90-24307	# p 262
A90-41954	p 244	N90-24333	# p 262
A90-42286	p 254	N90-24481	# p 263
A90-42287	p 254	N90-24710	# p 245
A90-42288	p 247	N90-24711	# p 245
A90-42289	p 254	N90-24712	# p 245
A90-42455 #	p 254	N90-24713	# p 250
		N90-24714	# p 250
N90-23861 *	p 244	N90-24715	# p 250
N90-23862 #	p 244	N90-24716	# p 250

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